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Quadrant Cooling Type Transformer

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ABSTRACT: This paper presents a modified design of quadrant cooling type transformer. In is the high voltage Transformer is cooled by the external fan using solar panel type. Fans are located in different quadrant. Different type of angle is used to locate the motor. The angle is between the 45 degree angle in the each quadrant . the motor is placed in the opposite direction to transformer .The motor in the linear form direction. The motor may be dc or ac motor, Increase of temperature rise and hot spot values affects dramatically transformer life expectancy. As system loads increase, equipment owners are looking to more innovative ways to safely increase the capacity of existing equipment. Short of replacement or a total redesign and rewind is not possible ,hence only the external cooling equipment can be augmented or upgraded. Wind power is one of the cooling power in the world. Used for rabid cooling system The place of cooling problem in perspective, the accepted rule of thumb is that the life expectancy of insulation in all electrics, including all transformers, it about the temperature every increase in operating transformer, this life expectancy having less in the life time role holding more narrowly when the increase in the heat of transformer winding it tends to failure. This project review based on the quadrant cooling of transformer using an air present in the surface.

KEYWORDS: solar type power, easily cool, high air power ,environmental free.

I. INTRODUCTION

In this project the transformer area is cooled by the external motor device using the solar panel. Solar panel is allocate in the different quadrant with the motor device. Based on the angle of transformer the motor is fixed for cooling system.

II. BASIC OF TRANSFORMER COOLING

The main source of heat generation in transformer is its copper loss or I^2R loss. Although there are other factors contribute heat in transformer such as hysteresis and eddy current losses but contribution of I^2R loss dominate them. If this heat is not dissipated properly, the temperature of the transformer will rise continually which may cause damages in paper insulation and liquid insulation medium of transformer. So it is essential to control the temperature with in permissible limit to ensure the long life of transformer by reducing thermal degradation of its insulation system. In electrical power transformer we use external transformer cooling system to accelerate the dissipation rate of heat of transformer. There are different transformer cooling methods

1) For dry type transformers

i) Air Natural (AN)
ii) Air Blast

2) oil immersed transformer

- ONAN Cooling of transformer
- ONAF Cooling of transformer
- OFOF Cooling of transformer
- OFWF Cooling of transformer
- ODAF Cooling of transformer
- ODWF Cooling of transformer

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a) Air Natural Or Self Air Cooled Transformer

This method of transformer cooling is generally used in small transformers (upto 3 MVA). In this method the transformer is allowed to cool by natural air flow surrounding it.

b) Air Blast

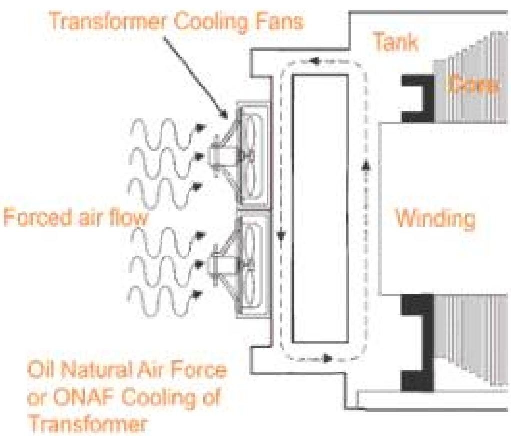
For transformers rated more than 3 MVA, cooling by natural air method is inadequate. In this method, air is forced on the core and windings with the help of fans or blowers. The air supply must be filtered to prevent the accumulation of dust particles in ventilation ducts. This method can be used for transformers upto 15 MVA.

Cooling Class Letter Description

		Letter	Description
Internal	First Letter (Cooling medium)	O	Liquid with flash point less than or equal to 300°C
		K	Liquid with flash point greater than 300°C
		L	Liquid with no measurable flash point
	Second Letter (Cooling mechanism)	N	Natural convection through cooling equipment and windings
		F	Forced circulation through cooling equipment, natural convection in windings
		D	Forced circulation through cooling equipment, directed flow in man windings
External	Third letter (Cooling medium)	A	Air
		W	Water
	Fourth letter (Cooling medium)	N	Natural convection
		F	Forced circulation

➢ **ONAN Cooling of Transformer**

This is the simplest transformer cooling system. The full form of ONAN is "Oil Natural Air Natural". Here natural convectional flow of hot oil is utilized for cooling. In convectional circulation of oil, the hot oil flows to the upper portion of the transformer tank and the vacant place is occupied by cold oil. This hot oil which comes to upper side, will dissipate heat in the atmosphere by natural conduction, convection & radiation in air and will become



In this way the oil in the transformer tank continually circulate when the transformer put into load. As the rate of dissipation of heat in air depends upon dissipating surface of the oil tank, it is essential to increase the effective surface area of the tank. So additional dissipating surface in the form of tubes or radiators connected to the

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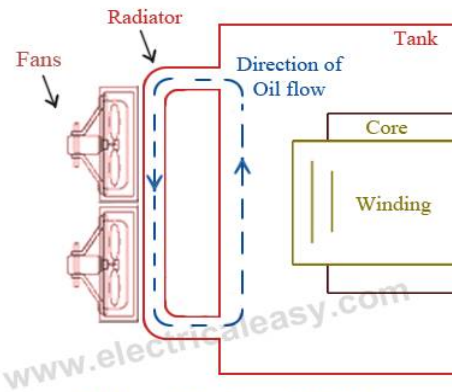
transformer tank. This is known as radiator of transformer or radiator bank of transformer. We have shown below a simplest form on natural cooling or ONAN cooling arrangement of an earthing transformer below.

Natural convection process is used for this type of cooling. The assembly of the core and windings are placed in the oil immersed tank. As the core and the windings heat up the temperature of the oil in the transformer rises. As a result, the oil moves upward and flows from the upper portion of the transformer tank. This hot oil dissipates heat in the air by natural convection and conduction process, the oil gets cooled by the circulation of natural air and passes through the radiator again for the use of the transformer. This type of cooling is used for the transformer rating up to 30 MVA.

- ***Oil Natural Air Forced (ONAF)***



Oil Natural Air Forced (ONAF)
Cooling of Transformer

The heat dissipation can be improved further by applying forced air on the dissipating surface. Forced air provides faster heat dissipation than natural air flow. In this method, fans are mounted near the radiator and may be provided with an automatic starting arrangement, which turns on when temperature increases beyond certain value. This transformer cooling method is generally used for large transformers upto about 60 MVA.

- **OFAF Cooling of Transformer**

In oil forced air natural cooling system of transformer, the heat dissipation is accelerated by using forced air on the dissipating surface but circulation of the hot oil in transformer tank is natural convectional flow.

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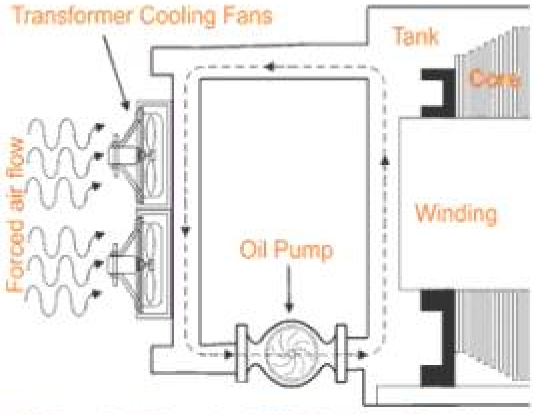

Oil Forced Air Forced or OFAF Cooling of Transformer

The heat dissipation rate can be still increased further if this oil circulation is accelerated by applying some force. In OFAF cooling system the oil is forced to circulate within the closed loop of transformer tank by means of oil pumps. OFAF means "Oil Forced Air Forced" cooling methods of transformer. The main advantage of this system is that it is compact system and for same cooling capacity OFAF occupies much less space than farmer two systems of transformer cooling. Actually in oil natural cooling system, the heat comes out from conducting part of the transformer is displaced from its position, in slower rate due to convectional flow of oil but in forced oil cooling system the heat is displaced from its origin as soon as it comes out in the oil, hence rate of cooling becomes faster.

III. BASIC OF SOLAR PANEL

Solar energy and other alternative energy sources thrive on devices that consume lesser power than that used with conventional power sources, besides; the increasing cost of energy generation has left every one searching for low power consumption devices. Focusing on a very essential electrical device used in every home and offices, this paper presents "the design and construction of multipurpose energy saving light emitting diode (LED) light".
Bright white LED with broadband spectrum wavelength were connected in series and parallel form on a reflecting but not conducting surface. A dual Power supply design mode was used such that either direct ac source of 220V or a 12V DC supply is compatible with it. The LEDs are however not directly powered by the supply voltage as they were energized through a low frequency pulse-width modulated circuit. which automatically effects varying light intensity.

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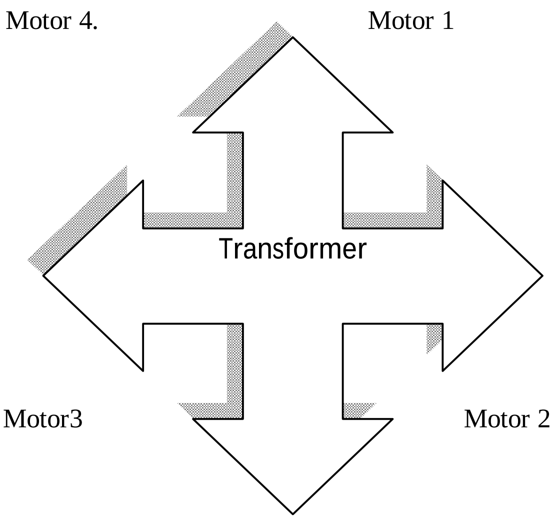
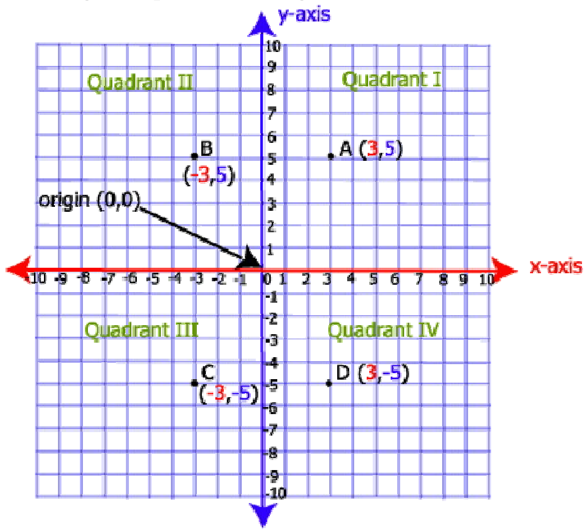
IV. QUADRANT TYPE SYSTEM



The quadrant operation is angle based system in the application. The angle is different in the position of the control technique used in transformer cooling . the position is angle 180' difference to the angle to the motor



The axes of a two-dimensional Cartesian system divide the plane into four infinite regions, called **quadrants**, each bounded by two half-axes.

These are often numbered from 1st to 4th and denoted by Roman numerals: I (where the signs of the two coordinates are (+,+)), II (−,+), III (−,−), and IV (+,−). When the axes are drawn according to the mathematical custom, the numbering goescounter-clockwise starting from the upper right ("northeast") quadrant.

The motor is operated in four quadrants i.e. clockwise; counter clock-wise, forward brake and reverse brake. It also has a feature of speed control. The four quadrant operation of the dc motor is best suited for industries where motors are used and as per requirement as they can rotate in clockwise, counter-clockwise and also apply brakes immediately in both the directions.

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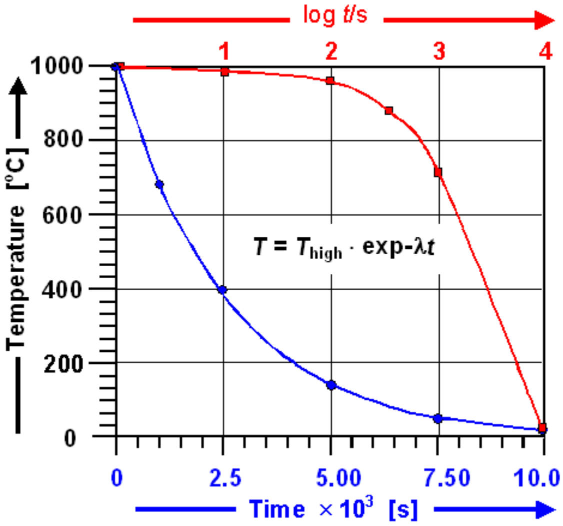
In case of a specific operation in industrial environment, the motor needs to be stopped immediately. In such scenario, this proposed system is very apt as forward brake and reverse brake are its integral features.
The concept behind the four quadrant matrix is very simple. On the X axis you map value to the customer (which presumably correlates to increased revenues
& drives customer satisfaction, upgrades and additional long-termsales). On the Y axis you put the cost/risk of developing the corresponding feature.



$$T = T_{high}.e^{-\lambda t}$$

Using a ranking system (usually based on gut feel rather than hard quantitative data, though the more data you use the better) you can then put each of the features you are considering on the matrix to evaluate payoff versus costs.

V. DC MOTOR PERFORMANCE

Operating DC motors from photovoltaic solar panels comes with some requirements in order for the motors to operate efficiently. DC motors require a stable power supply, which can only be achieved by installing some sub-systems into the overall motor system. The use of solar powered motors reduces greenhouse gas emissions, which leads to the global warming phenomena, especially when the application is used in an industrial, manufacturing

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environment. Commonly called solar panels, photovoltaic cells are the heart of any solar power supply system. Modern PV cells are mostly made from mono-crystalline silicon. A chemical reaction occurs when the silicon is introduced to sunlight, producing electricity as the electrons become excited. The electricity produced depends greatly on the efficiency of the cells and the availability of direct sunlight. Sunlight conversion efficiencies of 33 percent are available as of 2010.

Utilization of solar energy (by means of photovoltaic conversion) for driving electromechanical systems in remote places is becoming nowadays economical justified. Since the output of solar cells is DC voltage, the DC motor is an obvious candidate for these systems. The performance characteristics (operation and control characteristics) of the seperate, series and shunt excitation motors powered by the photovoltaic converter was an alysed. These characteristics are different from those of the conventional power supply.

If we hook up a solar panel directly to a dc electrical motor as shown in the picture, then the solar panel is sending power directly to the motor and the motor is using the electrical energy immediately. In this case the motor is "**Directly Poweredby Solar Energy**".

If we hook up the solar panel in a parallel circuit with a motor and a battery then the solar panel will charge the battery and the dc motor will get dc electrical energy from the battery. The energy used to power the motor came from the battery. However, the energy in the battery came from solar energy so we say that the motor is"**Indirectly Powered by Solar Energy**".

ADVANTAGES

- High efficiency.
- Quick cooling.
- Prevent damages.
- Reduce heat losses.
- Long durability.

DISADVANTAGE

- Cost is high.
- Can't used at winter season.
- Easily corrosion.

APPLICATION

- Used at HV side.
- Used at testing transformer.
- In industrial application.

VI. CONCLUSION

Thus the result of the this project. The cooling of the transformer is become much better than the previous system .The quadrant cooling transformer is the greatest technique in the cooling methodology .

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