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Transformer Parameter & Monitoring

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ABSTRACT

Transformer is the main equipment for well regulated power supply to the all consumers and industrial purposes. In this paper monitoring transformer for problem before they are occur it can prevent fault so that it is costly to repair and result in a loss of service. This is very important electrical device in our day to day life while working for electricity. So it is mandatory to observe and study about the transformer parameters. It always works on high level voltage. So, it is not possible to study and observe the parameters at place where the transformer is placed. In this paper we will understand the transformer parameters so that the caution is to be taken of those parameters. Here we will describe all the parameters of transformers.

Keywords : Transformer Parameter, Over And Under Voltage Protection, Over Current Protection

I. INTRODUCTION

A transformer is an electrical device which transfers electrical energy between two or more circuits through electromagnetic induction. A varying current in one winding of the transformer produces a varying magnetic field, which in turn induces a voltage in a second winding, because magnetic field, Power can be transferred without a metallic connection between the two circuits. Operation of the transformer was discovered by Michael Faraday in 1831, in 1832 Joseph Henry. Michael faradays discover the law of electromagnetic induction. and others. in 1870s, efficient generators producing alternating current (AC). Russian engineer Pavel Yablochkov invented a lighting system based in 1876 on a set of induction coils. In 1878, the Ganz Ganz factory, Budapest, Hungary, began producing equipment for electric lighting and, by 1883, had installed over fifty systems in Austria-Hungary. Protection against fault in power systems (PS) is very essential and important for credible performance. A power system is said to be error when an undesirable state occurs in that power system, where the undesirable condition might be short circuits, over-current, overvoltage etc. The power transformer is one of the most consequence instrument in the electric power system, and transformer protection is an important part of the general system protection approach. Transformers are used in a vast variety of applications, from small distribution transformers serving one or more users to very large units that are an integral part of the bulk power system. Increase in population leads to increase in demands of electrical power. With the increase in demand of power, the existing systems may become overloaded. Overloading at the purchaser end appears at the transformer terminals which can affect its capability and protection systems. To avoid the damaging of transformer due to overloading from purchaser end, it involves the control against over current.

II. MAIN COMPONENTS OF A TRANSFORMER

The major components of a transformer are the coil , the core, the tank or casing, the radiator, and the bushings as shown in Figure 1. Generally, transformer coil are made of copper because it has a lower resistance and is more capability compared to other metals. Each coil is wrapped with an insulating material such as paper. The primary coil is usually wound around the transformer core and the secondary coil is then wound on top of the primary coil. Between each coating of the coil, another coating of insulating material is wrapped to provide extra insulation between the coil. There are ten major transformer components (Ng 2007).

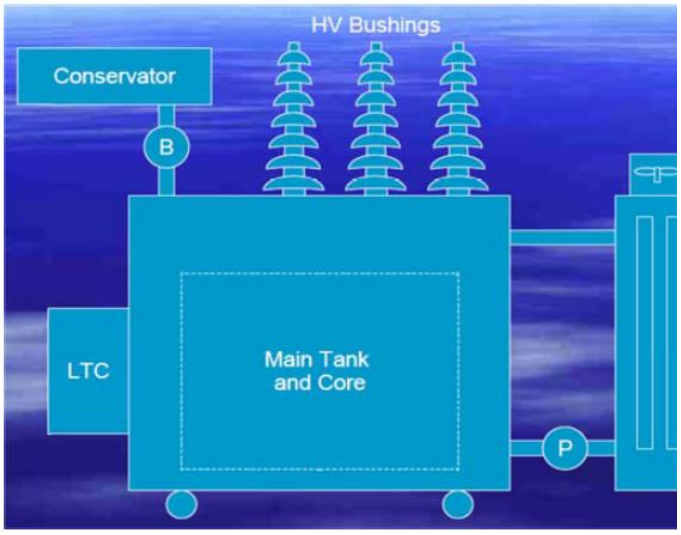

Fig 1 :- Main Transformer Components

These components can briefly be described as follows:

1) Core is a ferromagnetic material (commonly soft iron or laminated steel) that provides a path of high magnetic permeability from the primary circuit to the secondary circuit.

2) A secondary voltage to be induced in the secondary circuit from the alternating current (AC) voltage in the primary circuit in the coil. The change in magnetic field in the transformer core caused by applying primary AC voltage causes an induced magnetic field and voltage on the secondary winding.

3) Tank or casing, which is usually a reinforced rectangular structure in these transformers, consist the dielectric material, the core and the coil.

4) Dielectric material is a substance that is a poor conductor of electricity but an efficient supporter of electrostatic fields. It can be fluid oils, dry solids or gases.

5) The increase tank or conservator containing dry air or dry inert gas is maintained above the fluid level.

6) Bushing is an insulating structure that provides a conducting path though its centre, its primary function is to insulate the entrance for an energized conductor into the tank.

7) Pressboard barriers between the coils and core, are installed to increase the dielectric integrity of the transformer.

8) The tap changer is a connection point along a transformer winding that allows the number of turns to be selected, or so-called voltage regulating device.

9) The radiator feed a heat transfer path to dissipate the internal heat isolated in the transformer.

10) The pressure relief device is used to protect the tank against excessive pressure release inside a transformer tank.

An oil-insulated transformer is made up of a steel tank, which includes windings and the transformer's iron core. During the manufacturing phase, the windings are covered with insulation paper and electrical insulating board. The steel tank is full of transformer oil and it impregnates the insulation paper, during which time the combination of paper and oil and the electrical insulating board form a necessary electrical insulation.

Basic core and coil configurations differ little between dry and oil-insulated transformers. However, air is a much poorer conductor than dielectric fluid so that clearances between conducting surfaces can be much smaller in a liquid-filled transformer, allowing operating voltages to be much higher than with dry-type design.

To ensure that the transformer can operate without failure for at least 30 years and that the life expectancy of the transformer can be correctly estimated the properties of the transformer oil and insulating paper must be kept at a specific level.

Applications:

1. A transformer is an electrical device which is used for changing the A.C. voltages.

2. A transformer is a device that is used to either raise or lower voltages and current in an electrical circuit.

3. A transformer is used to boost voltage level so as to decrease line losses during transmission.

4. Transformer is used to increase or decrease the alternating voltages in 4electric power.

5. The transformer also electrically isolates the end user from contact with the supply voltage.

III. PARAMETERS TO BE MONITORED

A) Over Current Protection

Based on the research and practical implementation, an ammeter cannot be used in measuring the load current reason been that an analogue signal most be fed into the ADC of the microcontroller for monitoring the load current. A current transformer was found to be the suitable current sensing device for this research. The output of the current transformer is fed to Micro-controller ADC unit for taking the necessary action. The current flowing through the CT primary can be measured. The digital display is provided at the output of the Micro-controller Chip.

B.) Over and Under Voltageprotection

The 230Vac:12Vac step down voltage transformer is used to measure the load voltage. The voltage transformer will pass through rectification process before fed to the ADC. The over voltage and under voltage protection circuit is capable of measuring and monitoring voltage from 200 to 250voltage. In this research, the voltage can be increased or decreased by using the auto transformer and the output of the voltage monitoring circuit is fed to ADC converter, whenever the voltage is varied to 200Vac, the microcontroller will detect under voltage fault and whenever the voltage is varied to 250Vac, the microcontroller detects overvoltage fault, consequently the microcontroller sends a trip signal to the relay, and the relays cuts the primary of the transformer from the AC mains, thereby protecting the transformer.

C) Over Temperature

Extravagant load current alone may not result in damage to the transformer if the absolute temperature of the coil and transformer oil remains within specified limits. Transformer rating are based on a 24-hour average ambient temperature of 30°C (86°F).Due to overvoltage and over current, temperature of oil increases which causes failure of insulation of transformer winding.

D) Oil Level Fault

Oil mainly used in transformer for two purposes one is for cooling of transformer and another use for insulation purpose. Due to heating effect When temperature of transformer goes high, oil level in transformer tank decreases. For normal operation of transformer oil level should maintain at required level. If oil level decreases beyond required level, it affect cooling and insulation of the transformer. To protect transformer from this fault we'll use oil level sensor.

IV. CONCLUSION

Now a day's electricity is being one of the main important basic needs of our daily routine in human's life. To it is necessary that to maintaining the transformer parameter. Because day by day the time getting to the human being is less so remote operation is necessary. Protection of power transformers is a great challenge today. The power transformer are very costlier and in the range of few lacks since India is a growing economy and we can't afford to drain public capital so instead provide protection to every transformer which is cheap and reliable. The transformer voltage, current and temperature were monitored, as soon as a defect occurs; the protective relays are triggered OFF thereby protecting the transformer from damage. With the help of this system, the maintenance staff of the Electricity Power authority department can have a continuous vigilance over the transformer through a personal computer and rectify the problem from the computer without the need offline men. The goal of the research was achieved successfully. The research shows that the system is fully automated with no manual interface required.

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