BUCHHOLZ RELAY TESTING KIT

Mr. Rahul Ashok Bandekar [1], Mr. Mihir Sandip Wadekar [2], Mr. Cajetan David Dsouza [3] ,Mr. Sayyan Noormahammad Shaikh [4], Mr. Abdulgafur Mahammadjahur Shaikh[5], Ms. T. R. Shenai. [6]

[12345] Student, Yashwantrao Bhonsale Polytechnic, Sawantwadi, Maharashtra, India
[6] Faculty Yashwantrao Bhonsale Polytechnic, Sawantwadi, Maharashtra, India

---

Abstract - *Transformers are one of the most important components of an electrical power system, and protecting them is an essential requirement. The cost of the transformer is very high, so we have to protect it carefully because a single fault in the transformer can damage it. The first operation of the transformer was discovered by Michael Faraday in 1831 and Joseph Henry in 1832. A transformer is a static electrical device that transforms the electrical energy from one electrical circuit to another without any change in frequency through the process of electromagnetic induction. It is interesting to note that mutual induction, which is flux-induced in the circuits, is used to transmit energy from one circuit to another. This flux-induced induction in the primary winding gets linked with the secondary winding, which we shall explain in a while. A Buchholz relay is used to monitor a large transformer for oil loss or insulation breakdown. The location of the Buchholz relay is in between the transformer and conservation tank and connected through the pipe. The Buchholz relay is a protective device. It is generally used only in the protection of power transformers. A transformer's Buchholz relay, an oil-activated relay, is used to detect anomalies, including short circuits, overheating, and oil leaks. The main advantage of this method is that the relay kits are easy to manufacture. One of the most vital and expensive electrical devices is the transformer. A Buchholz relay is used to check for oil loss or insulation failure in big transformers is used to check for oil loss or insulation failure in big transformers. Between the transformer and its oil storage tank is an inclined pipe where the relay is housed.*

Key Words: Buchholz relay, Transformer, Conservator tank, Transformer tank, Air compressor.

1. INTRODUCTION

Max Buchholz created the Buchholz relay in 1921. The Buchholz relay is used for protection, which makes it sensitive to the effects of dielectric failure inside the equipment. That is a dome-shaped structure. Between the main transformer tank and the conservator tank is a Buchholz relay. When a transformer is heated or when a fault occurs, like a short circuit fault, a core fault causes core heating, an incipient fault causes inter-turn faults, and bubbles are created in the oil. Then Buchholz would relay the protection for the transformer. The relay has two mercury switches: an alarm and a trip switch, which are placed at the top and bottom of the chamber with a hinged float and flap, respectively. The relay operates when the transformer oil is heated due to fault current and decomposes into gas bubbles. The intensity of the fault produces a proportional amount of gas, which accumulates in therelay chamber and displaces oil equivalent to the volume of gas. Gas builds up at the top of the chamber during small failures, tilting the float downward and turning on the warning switch. The fault pushes the flap and engages the trip switch if the fault intensity is strong enough to generate a significant amount of gas. The main advantage of this method is that the relay kits are easy to manufacture and understand. Short circuits, overheating, and oil leaks are among the anomalies that a transformer's Buchholz relay, an oil-activated relay, is designed to find. It is a cylinder that is locatedin the line that joins the conservator to the main tank of sizable, oil-immersed transformers. Internal problems in an oil-filled transformer may generate heat, which may lead to the insulating oil dissolving into gases like methane, carbon monoxide, and hydrogen.

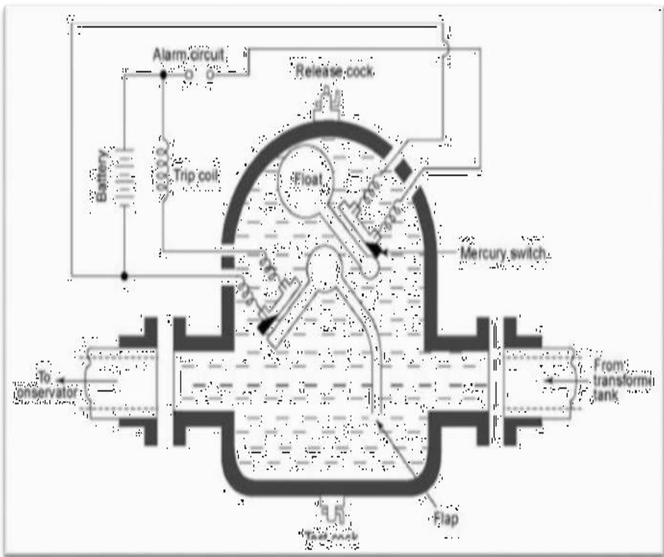

Fig No. 1 Circuit diagram of Buchholz relay testingkit.

1.1 OBJECTIVES

- To understand actual working of Buchholz relay afterfault occurrence.
- To protect transformer against all internal faults in transformer tank by using Buchholz relay.
- To analyze the performance of Buchholz relay.
- To detect defective conditions in order to provide safety to transformer

2. METHODOLOGY

The transformer is the heart of the power system. A key piece of equipment in a power system is the power transformer. It required a highly reliable protective device. The protective scheme depends on the size of the transformer used for transmission and distributionsystems, which range from a few KVA to several hundred MVA. For small transformers, a simple fuse is sufficient for protection. For medium-capacity transformers, overcurrent relays are used. For large transformers, a differential protection scheme is used. Transformers are connected to a load 24 hours a day,seven days a week. If a transformer gets damaged due to a fault, there will be a large impact on industrial, commercial, and residential areas. The cost of a transformer is very high, so we have to protect them carefully because a single fault in a transformer can damage it and reduce its life. It takes a long time to repair, and the replacement of a transformer makes things difficult. Hence, transformer protection is necessary. The different types of relays are used for the protection of transformers.

2.1 THERMAL RELAY

To safeguard the transformer windings from damage brought on by heating, thermal relays are employed tostop the transformer from overheating. Temperaturerelays will compare the data from the temperature sensors to a pre-set temperature value. An indication flags at the annunciator panel along with an alarm when the winding temperature reaches the present level for the alarm warning. The relay circuit delivers the signal to trip the transformer breaker if the temperature rises further and reaches the predetermined temperature threshold.

2.2 RESTRICTED EARTH FAULT RELAY

Restricted an earth fault relay that only works for faults occurring in a specific, localized zone is known asearth fault protection. The area between a transformer's earthed neutral terminal and start side winding is designated as the zone for protection. The system continues to operate normally since REF relays do not detect any earth faults outside of this zone. REF requires a current transformer with identical ratios and loads. The neutral CT and phase CT ratios will alter for larger electrical equipment, necessitating the installation of an additional current transformer to compensate for the ratio difference. Interposing current transformer, or ICT, is what that is the output of a current transformer shouldn't be shared. If a through fault occurs, the relay triggers thetrip mechanism as a result of any CT core becoming saturated. Relay stability deteriorates. By connecting a suitable stabilizing resistor in series with the operational coil, we may eliminate.

2.3 OVER CURRENT RELAY

There would essentially be a current coil in an overcurrent relay. Because the restraining force is greater than the deflecting force when normal current is flowing through this coil, the magnetic effect it produces is insufficient to cause the moving element ofthe relay to move. But as the current through the coil increases, the magnetic effect also does. At some point, the deflecting force produced by the coil's magnetic effect crosses the restraining force, which causes the moving element to begin moving in order to change the position of the contact in the relay. The instantaneousover-current relay is fairly easy to build and operate. In this case, a current coil typically winds a magnetic core. When there is insufficient current flowing through the coil, a piece of iron is placed into the relaywith a restraining spring and hinge support to keep the NO contacts open. The nodes close when the current in the coil reaches a predetermined amount, which causes the attractive force to be strong enough to draw the iron piece towards the magnetic core.

2.4 BUCHHOLZ RELAY

Every time a defect develops in the tank, the Buchholzrelay activates because it is based on the gases produced in the transformer tank during an internal failure. And disconnects the transformer from supply or generates an alarm in the case of an incipient fault. When an incipient fault develops in the transformer, it produces heat. Decomposition of solid and liquid insulating materials begins as a result of heat generation, producing combustible gases. When a certain number of gases build up in the relay chamber, the Buchholz relay activates an alert. By doing an analysis of gases, we can get an idea about the type ofincipient fault.

Gas that is produced in the transformer tank due to a fault rises towards the collector tank and gathers in the relay's upper chamber. Hence, the oil level in the relay drops, and the top float triggers an alarm switch. Gas shall not freely pass from the relay body and escape into the pipework before the alarm contact has operated. Large amounts of gases are produced in the main tank due to a significant failure. Which causes a violent flow of transformer oil. This oil in the main tank rushes towards the conservator tank through the Buchholz relay connected in the pipe, which connects the transformer tank and conservator. The lower float tilts to close the mercury switch's contact as a result of the turbulent oil flow. This completes the trippingcircuit to open the circuit breaker, and transformers get disconnected from the supply.

Different methods have been used to protect transformers, like Buchholz relays, thermal relays, REF relays, and over-current relays. However, Buchholz relay is good for transformer protection because its operation time is shorter than that of other relays. The Buchholz relay is a very sensitive device compared to other relays. The Buchholz relay is light weight, and it'ssuitable for indoor and outdoor substations. Normally, a protective relay does not indicate the appearance ofthe fault. It operates when a fault occurs. But Buchholz

Relay gives an indication of the fault at a very early stage by anticipating the fault and operating the alarm circuit. As a result, accidents can be avoided, and the transformer can be pulled out of service before suffering any major damage.

2.5 There are two type of methods for creating bubbles

2.5.1. By using heater

In this procedure, a heater will be connected to the transformer oil tank. In this way, a fault can be created at any time when heat is applied to transformer oil, where bubbles will be created and gas will be formed.This gas will then be passed to the Buchholz relay by pipe. The Buchholz relay will sense the fault and give a signal to the circuit breaker; the circuit breaker will trip, and the transformer will stay protected. Thismethod takes longer to complete.

2.5.2. By using air compressor

The cost of an air compressor is less, and it's easily available for us. In comparison to a heater, the operation of an air compressor is very simple and quick. The process of heating a heater is more time- consuming as compared to using an air compressor. The operation of an air compressor is simple and safe because there are no live parts on the outside.

That is why we decided to use an air compressor in our project.

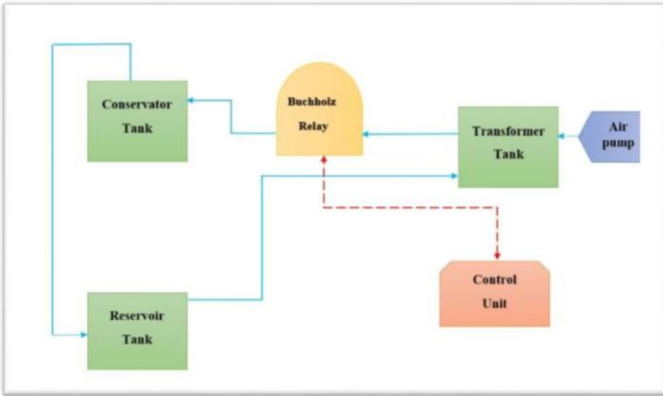

Fig.2. Block diagram of Buchholz relay testing kit.

Fig.3. Actual model of Buchholz relay testing kit.

3. ACKNOWLEDGEMENT

It is a great pleasure for me to express my most sincere heart felt gratitude to project guide Ms. T. R.Shenai. , for this valuable technical guidance & efforts during the completion of this synopsis. We are extremely thankful to Mr. B. M. Patil, head of the department of electrical engineering, for his everlastingmoral support as well as our teacher & co-operation. We are very much thankful to Principal Mr. G. A. Bhosale for his support & encouragement. This workwe completed with the blessing of our all family members. We express our sincere gratitude towards them for their kind co-operation & encouragement which helped us in completion of this project. We would like to express our sincere thanks to all teaching & non-teaching staff of department of electrical engineering. YBP for their expert advanced & help. Itwas indeed of fabulous experience & learning for us to this synopsis. Last but not the least we would like tothank all friends and well wishes that were involved directly and indirectly successful completion of the synopsis.

4. CONCLUSION

In this project, we will learn about the actual operation of a Buchholz relay after a fault has occurred. The main purpose is to observe and protect the transformer from all internal faults in the oil tank by using a Buchholz relay.

5. FUTURE SCOPE

In the future, wireless Buchholz relays will be developed. Relay connecting to the microcontroller and sensor. Sensor will sense the fault and send a signal to the microcontroller, then the microcontroller will send a signal to the trip circuit and the alarm circuit will start to beep, the circuit breaker will trip, and the transformer will stay protected.

REFERENCES

[1] IEEE Standard association "C57.104-1991 - IEEE GUIDE FOR THE INTERPRETATION OF GASES GENERATED IN OIL-IMMERSED TRANSFORMERS" IEEE Standard.

[2] Sitemason "TRANSFORMER OIL VOLUME CONVERSION TABLE".

[3] H. C. Hitchcock," BUCHHOLZ RELAYS, SUPPLY WAS RESTORED IN A MATTER OF MINUTES" THE 1968 INANGAHUA EARTHQUAKE AND ELECTRICTY SERVICES.

[4] E. Takahashi K. Tanaka K. Toda M. Ikeda, T. Teranishi, M. Inaba T. Yanari, "DEVELOPMENT OF LARGECAPACITY GAS-INSULATED TRANSFORMER" IEEE Transactions on Power Delivery, Vol. 11, No. 2, April 1996.

[5] M. Duval, J. Aubin, Y. Giguere, G. Pare and Y. Langhame, "OIL ADDITIVES FOR THE EVALUATION OF HOT SPOT TEMPERATURE IN POWER TRANSFORMER DURING OVERLOADING " IEEE Transaction.

[6] ALTERNATIVES OF BUCHHOLZ RELAY AND MORE ROBUST SCHEMES FOR TRANSFORMER INTERNAL FAULT PROTECTION Dr. Nishant Kumar.