

DESIGN AND DEVELOPMENT OF THREE PHASE TRANSFORMER TESTING PANEL

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ABSTRACT:

We know in electrical engineering, the importance of transformer. Transformer plays an important role in electrical engineering. When transformer are received from the factory or reallocated from another location it is necessary to verify that each transformer is faulty or not. In manual method, lots of time is required to test any type of transformer and it is very risk operation. In this paper various intelligence techniques are used to test transformer such techniques are voltage ratio test, magnetic balance test, vector group test, megger test and charging test, etc. This study focuses on the temperature of transformer winding, winding resistance, voltage ratio of HV-LV side, etc.

Keywords- Megger test, Charging test, Magnetic Balance test, Voltage Ratio Test, Vector Group test.

1. INTRODUCTION:

Transformer is the heart of power system. Transformer is largest most expensive device. Transformer is a static device, a number of method have been introduced and employed on transformer to find internal defect within the valuable asset. The electricity created at generating stations is transported over high voltage power grid is split into many various sections. System, wherever power is transmitted from generating station and station via conductor to shopper inchoate

Transformers play a very important role within the power grid. They help transfer power to acceptable levels that alternative parts are designed. For an extended time and solely pack up throughout power interruptions and maintenance. Thanks to the strain they take, it is important to often assess their functions to make sure continuous service. Fault detection in transformers will offer early warning of electrical failure and might forestall losses. Transformer depends directly on the lifetime of its insulation.

2. LITERATURE REVIEW:

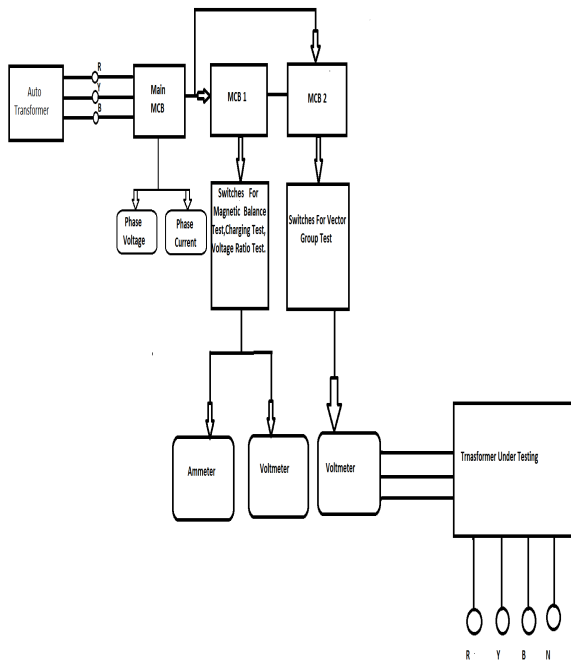
Transformer is important part in the electrical system. After manufacturing of transformer testing of transformer is essential work. Testing of transformer gives basic information about transformer, such as insulation quality, accuracy of transformer, health of winding, losses of transformer, etc. In many industry, there is different techniques for testing of transformer. So these problems are led us to think about this project.

This testing panel gives the information about health of transformer. In this testing panel, five different tests are performed such as megger test, charging test, magnetic balance test, ratio test, vector grouping test. After these test we can perform the basic load test, which is important of transformer. In this paper, a literature review is presented scanning the most important contributions in this topic.

3. OBJECTIVES:

1. Performing Megger test which gives information about resistance of transformer winding and body.
2. Performing charging test and magnetic balance test which is important to deciding the no load current and any external loop within the winding.
3. Gives the information about voltage ratio and vector grouping of transformer.
4. Gives the protection during testing of transformer, reduce the risk of accident during testing .

4. Block Diagram:



1. BLOCK DIAGRAM :

Block diagram shows the overall flow of project. In this block diagram, first block shows the auto transformer which gives supply to the testing panel. Supply of autotransformer is depend upon the transformer under testing. Indicators are used to show the supply is coming. Next block is main

MCB ,which is used for protection of testing panel. Phase voltage and phase current are measured through ammeter and voltmeter. Through main MCB supply is divided into two MCB. MCB1 is used for giving the protection for the

switches of megger test, charging test, magnetic balance test, voltage ratio test. The measured values are indiated in voltmeter and ammeter. MCB2 is used for giving the protection for vector grouping test. Necessary voltage is shown in the voltmeter which is measured during vector grouping test. After all transformer under testing is come in picture.

5. METHODOLOGY:

Tests to be conducted:

1. Megger Test
2. Charging Test
3. Magnetic Balance Test
4. Voltage Ratio Test
5. Vector Group Test

1. Megger Test:

Megger is additionally referred to as a Mega ohmmeter and could be a device used for the testing of insulation resistance of a cable. Test performed thus to understand the insulation resistance worth is through as Megger test.

The procedure of insulation resistance test or megger test is given below:

- First we are going to disconnect all the line and neutral terminals of the electrical device.
- Megger leads area unit connected to LV and HV bushing studs to live Insulation Resistance IR worth in between the fifty-five and HV windings.

- Megger leads are connected to HV bushing studs and transformer tank earth purpose to live Insulation Resistance IR worth in between the HV windings and earth.
- Megger leads are connected to LV bushing studs and transformer tank earth purpose to live Insulation Resistance IR worth in between the fifty-five windings and earth.

Observation Table:

HV to Earth	2000 Mega ohm
LV to Earth	2000 Mega Ohm
HV to LV	3000 ohm

Table 1. Megger Test

2. Charging Test:

Charging test is nothing however magnetizing current check. This check square measure performed to see or realize the transformer square measure energized at specific voltage and frequency. Magnetizing current is employed to point the full current square measure flowing into the first facet of the transformer once transformer energized at specific voltage and frequency. In this test magnetizing current is nothing but a combination of current required to the magnetize core and current required to supply the losses in the core.

Measuring condition:

When measurement magnetizing current, you must ordinarily program the check to use the very best operating voltage at the bottom operating frequency to the first winding.

In the case of a transformer with a split primary, the check may be conducted equally well by energizing only 1 of the first windings, as hostile the 2 serial. The expected current is going to be bigger for the one winding, rising in proportion to the turn's ratio:

$$IA = IAB \times (NAB / NA)$$

Where,

IA = the current to be specified when testing with winding A

IAB = the current for windings A and B in series

NA = the number of turns on winding A

NAB = the number of turns on A and B in series

(As an alternative, the formula above can be written using the voltage ratio between the two windings, rather than the turn's ratio.)

Observation Table:

Tap No.	Voltage			Current (in mA)		
	Vrn	Vyn	Vbn	Irn	Ibn	Ibn
1	100	100	100	0.75	0.5	0.7

Table2. Charging Test

3. Magnetic Balance Test:

Magnetic Balance check could also be a most usually used proactive check to search out faults inside the core and/or the windings of the device at early stage of manufacturing at works. though' thought-about as a result of the only check to conduct, usually it's difficult to interpret the results once and for all owing to some unpredictable variations in restraint results. Invariably, for authenticating the analysis of results, we've to conduct some supplementary tests conjointly. Magnetic balance check and conjointly the complementary magnetizing current measurements, that unit of measurement recognized as very effective tests to search out typical problems like:

- Inter-turn shorting
- Inter-strand shorting
- Any external loops around the core
- Abnormal magnetizing current attributable to unequal turns in winding sections connected in parallel
- Wrong interleaving joints in windings.

Transformer is connected in either two fashions.

- Star
- Delta

Star Fashion:

Just in case of failure of two phases in device (RY, YB or BR) just one limb of electrical device can manufacture flux by exploitation neutral purpose. the foremost aim of this check is therefore tested, that flux created by one limb is that the add of fluxes of various two limbs. From the results, we tend to area unit able to say that core is in healthy condition.

Delta Fashion:

Just in case of failure of one introduce device (either R, Y, or B) then just one limb of electrical device can manufacture flux and in remaining two limbs can give return path for that flux, the foremost aim of this take a glance at is to prove, flux created by one limb is that the add of fluxes of various two limbs thus we tend to area unit able to say core haven't got any disadvantage for path of flux.

Test procedure:

Apply 3 half 415V voltages to coil of electrical device and deduct anyone half for delta fashion winding and take away any two winding for star fashion winding. Place in writing the voltages in three phases by exploitation multi meter in primary and secondary windings.

- Line to line voltage simply {in case just in case} of delta fashion.
- Line to neutral voltage simply in case of star fashion.

Observation Table:

Tap No.	HV			LV		
	RY	YB	BR	rn	yn	Bn
1	425	299	121	9.56	6.93	2.81
	215	424	204	4.90	9.76	4.59
	129	288	424	2.93	6.66	9.76

Table 3. Magnetic Balance Test

4. Voltage Ratio Test:

Transformer turn's quantitative relation measurements square measure performed to verify the essential operational principle of an influence electrical device. By live the quantitative relation and phase from one winding to the other, open circuits and shorted turns are detected. The turn's quantitative relation is ready exploitation mill Acceptance takes a look at and desires to be checked routinely once the electrical device is in-service. Electrical device turns quantitative relation measurements can also be triggered by a visit relay and different diagnostic tests like Dissolved Gas Analysis (DGA) and dissipation issue/power issue measurements. the same old tolerance on the measured quantitative relation have to be compelled to sometimes be among zero.5 you take care of the plate ratings. However, in some cases wherever the number of turns during a} very given winding is improbably low; the standards alter the quantitative relation to be correct to the nearest flip (rather than zero.5% tolerance).

Test procedure:

This take a look at verifies that the electrical device windings have the right vary of turns thus on manufacture the required voltages.

This take a look at is assigned by using a "ratio meter" that applies associate AC voltage to the first windings. The first windings square measure connected to the 3 section 400V ac offer. Quickly once turning ON the supply, voltage starts inducement among the coil. The magnitude relation meter, a potential divider thereon thousand square measure provided so voltage across sound and voltage applied to the quantitative relation meter bears a seamless quantitative relation. By suitably

adjusting the voltage magnitude relation of quantitative relation meter the present flowing through the meter is formed zero that indicates that secondary voltage of magnitude relation meter.

Observation Table:

Tap No.	No. Plate Ratio	R		
		Vin	Vout	Ratio Vin/Vout
1	2.60	100.6	38	2.64

Tap No.	No. Plate Ratio	Y		
		Vin	Vout	Ratio Vin/Vout
1	2.60	100.2	38	2.63

Tap No.	No. Plate Ratio	B		
		Vin	Vout	Ratio Vin/Vout
1	2.60	100.3	38	2.63

Table 4. Voltage Ratio Test

5. Vector Group Test:

According to consumer’s facet, vector association of electrical device is most vital issue. Thus it important to see the interconnection of winding as per demand of consumer’s. In 3 section transformer, its encompass 3 sets of primary windings and 3 sets of secondary, wound on a similar iron core.

Vector cluster take a look at is very important, once 2 transformers are connected in parallel, as a result of throughout that point, there ought to be apprehend that their section shifts. If section shift isn't in identical manner then there's a risk of short, once transformer are energized

The basic plan regarding is that the winding’s association, on the essential of winding’s association, vector cluster of transformer is determined. Vector cluster set shoes the section distinction between primary and secondary windings.

This take a look at ensures all the first and secondary windings are known and terminated properly. As we all know most of the distribution transformer are within the vector cluster of Dyn11.

Test procedure:

first keep the faucet changer of electrical device in traditional position.

Short circuit R-phase of primary and secondary windings.

then apply 3 sections 440V AC provide across one in the entire HV winding terminal.

measuring the voltage within the 3 section of HV terminals

There are 3 limbs facet by in an exceedingly core transformer. One section winding is wound in one limb. The voltage evoked in numerous phases upon the individual position of the limbs within the core.

The voltage evoked in secondary section of transformer in relevancy neutral terminals given below.

To confirm Dyn11vector cluster refer following condition.

- $RY=YB=BR$
- $Rn+Yn=RY$
- $By>Bb$
- $Yb=Yy$

Observation Table:

Vector Group –Dyn11

Conditions	Result
$RY=Rn+Yn$	$425=9.56+417$
$Ry=Yb$	$413=413$
$By>Bn>By$	$415>425>428$

Table 5. Vector Group Test

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