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Impact of Inspection Strategy on Repairing Cost of Distribution Transformer

Nirav J Patel[1], Nikunj J Dhimar[2], Pratik D Solanki[3] and Jay A Patel[4]
[1]Lecturer, Electrical Department, Government Polytechnic, Bhuj, Gujarat, India
[2]Assistant Professor Electrical Department, Government Engineering College, Bharuch, Gujarat, India
[3]Assistant Professor, Electrical Department, Faculty of Engineering Technology and Research, Bardoli, Gujarat, India
[4]Assistant Professor, Electrical Department, Chhotubhai Gopalbhai Patel Institute of Technology, Bardoli, Gujarat, India
E-Mail: ernirav911@gmail.com, njd.fetr@gmail.com, pds.fetr@gmail.com, jay.patel@utu.ac.in
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***Abstract* - The Objective of the paper is to do Proper Inspection procedure of failed distribution transformer will reduce the repairing cost. Methods and Statistical analysis includes steps to do external and Internal Inspection with care so that it will not add any pointless expense. This paper highlights the Life cycle of failed distribution transformer and foremost objectives of Inspection which is directly affecting the procedure of repairing and its overall repairing cost. Findings of the paper convey that Inspection of failed distribution transformer is a planned technical extent which will affect directly to repair cost. The project can be applied for Proper Inspection practice will absolutely reduce the repair cost and over all transformer repairing expense of DISCOM.**
***Keywords:* External Inspection, Impact of Inspection, Repairing cost**

I. INTRODUCTION

This paper focused on the how Exterior and inside inspection procedure matters of overall repairing cost of DISCOM. Transformer fail in the field will start to make its expense including its transportation from field to divisional store and to the repairing company. From the very first transformer receive at the store of any divisional office. Main responsibilities start for the concern authority or Transformer Maintenance engineer. DGVCL come in the best rank distribution company of India as per as its income and revenue generation concern[1][2]. We have considered its External Internal Inspection procedure in case of repairing transformer which is not comes under guaranty and warranty [Fig.1].

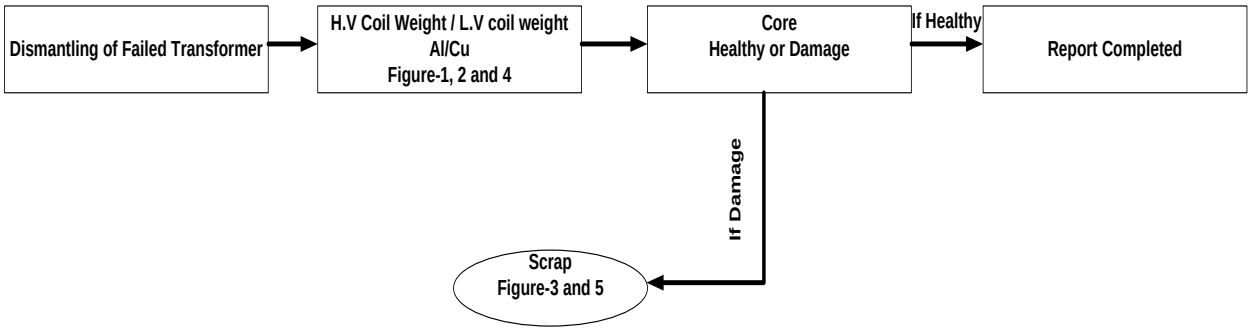

Fig. 1 Internal Inspection procedure of Failed Distribution transformer

Generally External inspection done as failed transformer comes at divisional store. Then it will send to repairing company then Internal Inspection carried out by the Inspection team. This is the technical procedure which needs very careful as it's directly affecting the repairing cost. It is very important to do External inspection at the store by the transformer maintenance engineer. An internal inspection carried out at the repairing company. Both the inspection carried out at Dakshin Gujarat Vij Company LTD [DGVCL] consider in this paper as DGVCL is coming in good rank in INDIA. So we consider it for concern.

Procedures of inspection properly mention which is carried out in this DISCOM. Also how it will affect and matter to reduce the cost of repairing.From the history card of Vapi Division Major observations for failure of transformer included [3][4]:

1. Surge arrester not properly placed or missing.
2. Breather missing
3. Improper, loose or unpracticed low voltage [LV] supplies connection.
4. Grounding not done properly
5. Damage or broken bushings
6. Broken earth conductors or not connected properly
7. Oil Leakage

This may be the reason of failure of many of the transformer during the year 2015-2016.

II. EXTERNAL INSPECTION

External inspection mainly concern with the Oil, bushing, any kind of leakage on the body of the transformer, Breather. Examiner engineer should observe and check transformer very carefully and make an external report based on all the Outer peripherals of the transformer. Oil is costly, so it should be necessary to check oil quantity available in transformer before it sends for repair. To check Oil quantity is challenging task as the entire transformer has the different oil storage capacity even though two same capacities of 100KVA transformers have different oil capacity. Negligence in this regard affects system repairing budget.

III. INTERNAL INSPECTION

It is compulsory to lock transformer with a seal by the concern authority before sending transformer at repairing company. This may protect the transformer to attain any unauthentic operation. Check oil of all transformers by the repairing engineer in the presence of inspection team. This is also verified with the External inspection report. External inspection carried out again for verifying. Then dismantle all transformers to be inspecting of internal inspection. All HV Damage coils must be impaired by the repairing engineer in the presence of the inspection team. This may avoid reprocess of the damaged HV coil. The weight of the coil should be measured very carefully as it increases the cost of repairing.

Fig. 2 LV Coil Inspection

Fig. 3 HV Coil inspection for damage and weight.

Fig. 4 Damage coil inspection and scrap

Fig. 5 HV Coil Separation for weight

Fig. 6 Core damaged for scrap

[Figure. 2, 3, 4, 5 and 6 Source: 1. DGVCL Failed Distribution transformer-Distribution company 2. Trans Electro Valsad-Repairing Company 3. Ashish Electrical Vapi-Repairing Company]

IV. TESTING

1. Open Circuit Test
2. Short circuit Test
3. DVDF (Double Voltage Double Frequency) Test
4. Back to Back Test

A. Cycle of Fail transformer [Fig. 7]
In distribution jurisdiction,

1. Hierarchy of DISCOM [Distribution Company]
2. Distribution Company
3. Circle Office
4. Division office [Operation and maintenance]
5. Sub division office [Field]

Division and Subdivision are mainly concerned with Operation and maintenance [O&M]. A large amount of money either to spend or to save it is depends on how smartly its being operate. A number of the transformer is placed in the field as well as transformer rotates in its life cycle [Fig-7].Fail transformer from the field received by subdivision. It will send to the Store of Division office where it is inspected [external Inspection]. Next it will send to the repairing agency where it is inspected by Inspection team and repairing company engineer [Internal Inspection] after testing of transformer, it is given back to the division with assured for commissioning.

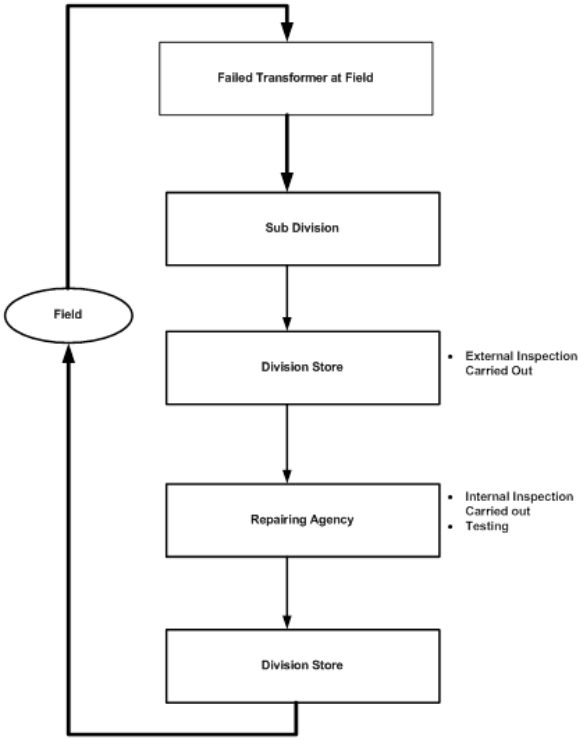

Fig. 7 Cycle of failed distribution transformer

Transformer not comes under any service guaranty or repairing warranty period.

$$T_c = Tm + Tr + T_t$$

Where, T_c = Cost for Transformer at field
T_m=Maintenance cost of transformer
T_r=Repairing cost of transformer
T_t=Transportation cost

In above equation, total cost of transformer located in field to repair and again back to the field mainly concern with three main factors. Maintenance cost, Repairing cost and transportation cost. In which Tm is also part of strategic management of maintenance. T_t is almost stable. By improving Inspection strategy T_r will be decrease. This directly affect in repairing cost expense [3][4][5].

V.CONCLUSION

The External and Internal inspection is very important as per as cost and reliability of distribution transformer is a concern. The proper inspection procedure will definitely reduce the cost of per transformer and over all repairing expenses of DISCOM. The future work carried out for taking year wise cost analysis according to necessary changes make during inspection procedure.

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