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Causes of Failure of Distribution Transformer and its Remedial Measures

KEYWORDS: Distribution Transformer, reason for failure, and remedial measures

Hitendrasinh C. Chawda

Lect. In Electrical Engg. Dept. of Electrical Engineering, R.C.T.I. Sola, Ahmedabad, Gujarat.

ABSTRACT *A Distribution Transformer (DT) is utilized to step down the voltage from 11 KV to 0.433 KV/0.250KV so that the electrical power is usable for providing supply to the customers such as domestic, commercial, industrial, LT, etc. A registered consumer expects uninterrupted power supply because during the failure of power supply, all works be it domestic, official, commercial or industrial comes to a standstill. Hence, transformer failure leads to consumer complaints and unnecessary emergency for the Utility to restore the power supply. In urban areas, the reason for failure of power supply due to failure of transformer is not too frequent, whereas in rural areas most of the power failures are attributable to the failure of distribution transformers. Failure of distribution transformers results in considerable revenue loss and entails heavy expenditure for replacement. This paper is on DT maintenance and reduction of failure, it does not describe the engineering know-how of prevention but ensures the use of these skills from the huge collective knowledge of our vast human resources.*

I. Reasons for failure of Distribution Transformers and the remedial measures thereof:

The probable causes for failure of Distribution Transformers in both urban and rural areas and factors responsible and their remedial measures are as following:

1. Overloading

Factors: A) Absence of record on the loading of the transformer. B) Granting of load sanction without taking into account loading on the transformer. C) Unauthorized usage/ theft of power

Remedial Measures: A) Maintaining proper record of the total number of consumers along with the connected load. B) Maintaining proper record on loading of the transformer. C) DT metering (static). D) Augmentation of transformer or construction of new sub-station. E) Disconnection of illegal connections

2. Imbalance loading

Factors: A) Absence of record on the phase B) loading of the transformer. C) B) Improper service connection to consumers without taking into account the phase load D) Long single/two phase line.

Remedial Measures: A) Maintaining the record of the phase wise loading and regular load balance accordingly B) Service connection to be given from the appropriate phase(s) only after taking proper shutdown C) Phase conversion

3. Low transformer oil level

Factors: A) Leakage of oil B) Theft of oil

Remedial Measures: A) Proper tightening of terminals and joints and replacement of loose/burnt out gaskets B) Proper sealing of valves C) Use of REC valves

4. Low break Down Value (BDV) of the transformer oil and poor insulation resistance(IR) Value

Factors: A) Overheating of transformer. B) Entry of moisture and contaminants. C) Burnt out insulation in the winding & core. D) Acidity formation due to the combined effect of heat, dissolution of varnishes & cellulose. E) Sludge formation due to continuous heating and thereby decomposition of the insulation material which then gets dissolved in the oil.

Remedial Measures: A) Augmentation of transformer or construction of a new substation. B) Proper tightening of terminals and joints. C) Replacement of deteriorated gaskets. D) Replacement of cracked bushings. E) Prompt replacement of deteriorated silica gel & dirty oil in the breather. F) Periodical testing of oil. G) Filtration/overhauling of transformer oil as & when required after testing

5. Poor earthing or absence of earthing

Factors: A) High soil resistivity of the earth pit B) Disconnected earth wire or rusted earth wire.

Remedial Measures: A) Periodical checking of the soil resistivity. Renovation of earth pit or making a new earth pit. B) Periodical checking of earth connections. Tightening of the terminal connections.

6. Lightning

Factors: A) High soil resistivity of the earth pit B) Undersized loop, especially from the conductor to the L.A. C) Disconnection earth wire and rusted earth wire. D) Common earthing. E) Absence of lightning arrestors / damaged lightning arrestors.

Remedial Measures: A) Periodical checking of the soil resistivity. Renovation of earth pit or making a new earth pit. B) Usage of the appropriate size of earthing loop C) Periodical checking of earth wire and earth connection. D) Tightening of the terminal connections. E) Earthing loop of LA's is to be separate. F) Installation/ replacement of LA's

7. Improper or poor cable terminal

Factors: A) Loose connection B) Poor lugging

Remedial Measures: A) Proper tightening of terminal connections. B) Proper lugging and usage of appropriate size of lugs.

8. Burning of transformer

Factors: A) Leakage of oil at terminals. B) Short circuit be-

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tween cables due to failure of insulation. C) Fire due to weeds/ jungles etc

Remedial Measures: A) Proper tightening of terminals and joints, and replacement of loose burnt out gaskets B) Regular check of the insulation of cables. C) Periodical cleaning of substation.

9. External short circuit
Factors: A) Long LT line span B) Poor safety clearance. C) Sagging of conductors. D) Accumulation of dust on bushings. E) Contact of the conductor with trees / branches.

Remedial Measures: A) Erection of intermediary poles where necessary. B) Place spacers where necessary and maintain safety clearance between conductors. C) Maintain sag of conductors as per standard. D) Cleaning of bushings E) Regular jungle clearing

10.Overrated fuses
Factors: A) Non availability of rated fuse. B) Ignorance of the field staff on the appropriate ratings. C) Use of conductor as fuse

Remedial Measures: A) Prompt requisition and procurement of fuse. B) Training of staff on the purpose of fuse, correct size and implications of overrating. C) Discourage the use of conductor as fuse wire

11.Flash over
Factors: A) Absence of arcing horn or arcing horns are not fitted properly. B) Dirty bushings

Remedial Measures: A) Proper fitting of arcing horns. B) Periodical cleaning of bushings.

12.Lack of testing of transformer and sub-station equipments
Factors: A) Non availability of megger earth tester, filter machine, oil testing kit. B) Absence of a routine for testing. C) Shortage of staff

Remedial Measures: A) Each sub-division should have megger, tong tester, and earth tester and each division should have an oil filter machine and oil testing kit. B) Testing schedule to be compiled and implemented. C) Outsourcing of the testing.

13.Vandalism
Factors: A) Unsecured sub-station B) Lack of awareness among the public

Remedial Measures: A) Proper fencing and the gate(with lock if needed). B) Danger plate in the substation. C) Public awareness through media and meetings.

II. CONCLUSION

From above it can be seen that the main factors which contribute to Distribution Transformer failure are:

1. Non implementation of the construction standards.
2. Absence of records on number of consumers, loading and history of the sub-station.
3. Absence of a well prepared action plan for distribution transformer failure reduction.
4. Absence of inspection, testing and maintenance schedule and non-implementation thereof.
5. Absence of inspection, testing and maintenance record on every sub-station.
6. Irresponsibility and carelessness on the part of some personnel.
7. Absence of proper reporting and clear guidelines at different levels.
8. Shortage of staff.

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