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Study, Design & Manufacturing of Mobile Transformer Oil Filter Plant, Degassing & Drying Unit

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ABSTRACT: Main objective is to manufacture a mobile oil filter plant with the ability of degassing & drying of oil. And also to increase the quality of used transformer oil. Manufacturing of this oil Filtration plant is done with the help of paper filter, magnetic filter and micron filter. Removing of moisture present in the oil with the help of vacuum pump. Sample of used oil of 500 Litre is tested with the manufactured mobile filter plant, the results were very positive. The moisture content in the oil is 3 ppm after the filtration of oil. The Di-Electric strength of oil increased as expected.

KEYWORDS: Transformer oil, Di-Electric strength, Filtration, Mobile plant, Degassing and Drying.

1 INTRODUCTION

A Transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction. The main components of transformer are core, winding, insulation and tank. The purpose of transformer core is to provide a low reluctance path for the magnetic flux linking the primary and secondary windings. The primary and secondary windings are arranged so as to reduce leakage flux in transformer. In doing so the core experiences iron losses due to hysteresis and eddy currents flow, which manifest themselves as heat. To dissipate this generated heat, coolant is used.

It is normally obtained by fractional distillation and subsequent treatment of crude petroleum. That is why it is known as Mineral Insulating Oil or Transformer Oil.

Transformer oil serves mainly two purposes one is liquid insulation in electrical power transformer and two is it dissipates heat of transformer i.e., acts as coolant

In addition to these, this oil serves other two purposes, it helps to preserve the core and winding as these are fully immersed inside oil and another important purpose of this oil is, it prevents direct contact of atmospheric oxygen with cellulose made paper insulation of windings, which is susceptible to oxidation.

Generally there are two types of Transformer Oil used in transformer:

1. Paraffin based transformer oil.
2. Naphtha based transformer oil.

The objective of current work is to study Manufacturing and testing results of transformer oil. Using various types of filters.

NEED FOR TRANSFORMER OIL FILTERATION MACHINE:

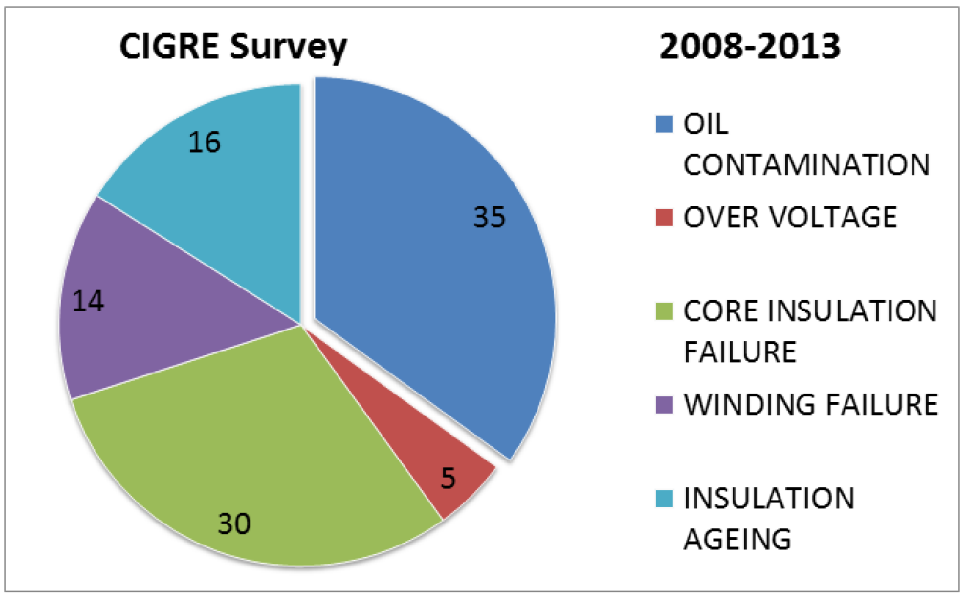
Reliable performance of transformer depends on certain basic oil characteristics which can affect overall performance of the electrical equipment. These characteristics include:

1. High dielectric strength to withstand stresses in service.
2. Proper oxidation resistance to ensure long life in service.
3. Good resistance to emulsion to prevent holding water in suspension in it.
4. Free from inorganic acid, alkali and corrosive sulphur which causes corrosion of metal parts and accelerate the production of sludge.
5. Low water content.
6. Appearance of oil shall be clear, transparent and free from suspended matter or sediments.

- The condition of oil greatly affects the performance and service life of transformers. A combination of electrical, physical and chemical tests is performed to measure the change in the electrical properties, extent of contamination and degree of deterioration in the insulating oil.
- The results are used to establish preventive maintenance procedures to avoid costly shut downs and premature equipment failure and the service life of equipment.
- To avoid such drastic consequences a machine is required to filter the oil and restore its working conditions.

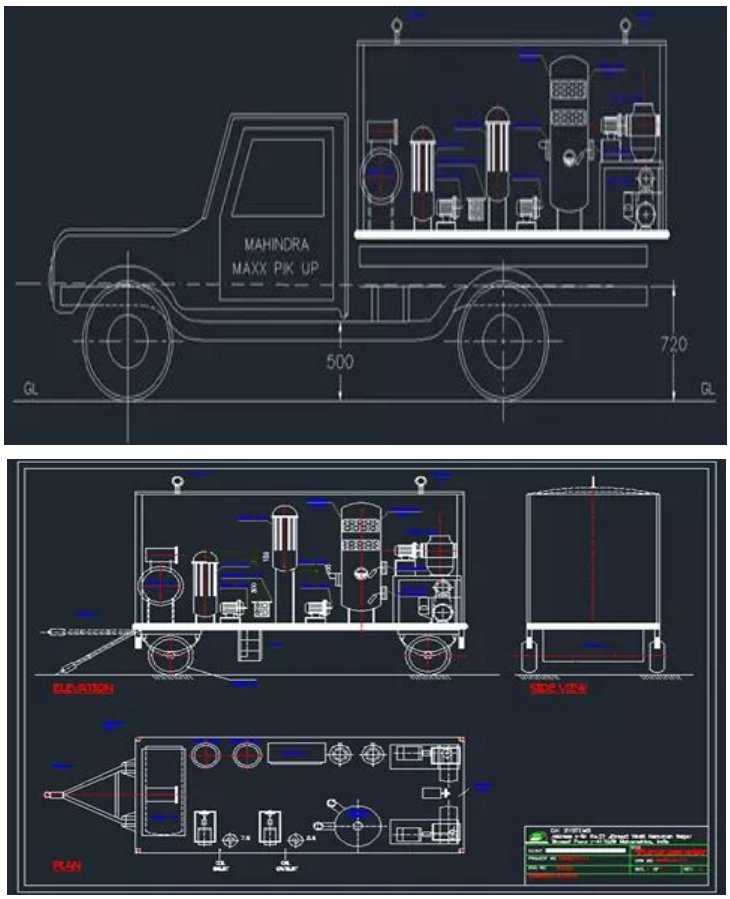
CAUSES OF FAILURE:

A survey conducted by The International Council on Large Electric Systems (CIGRE) indicates that main causes of transformer failures (51 percent in a last five year period) are due to following reasons:



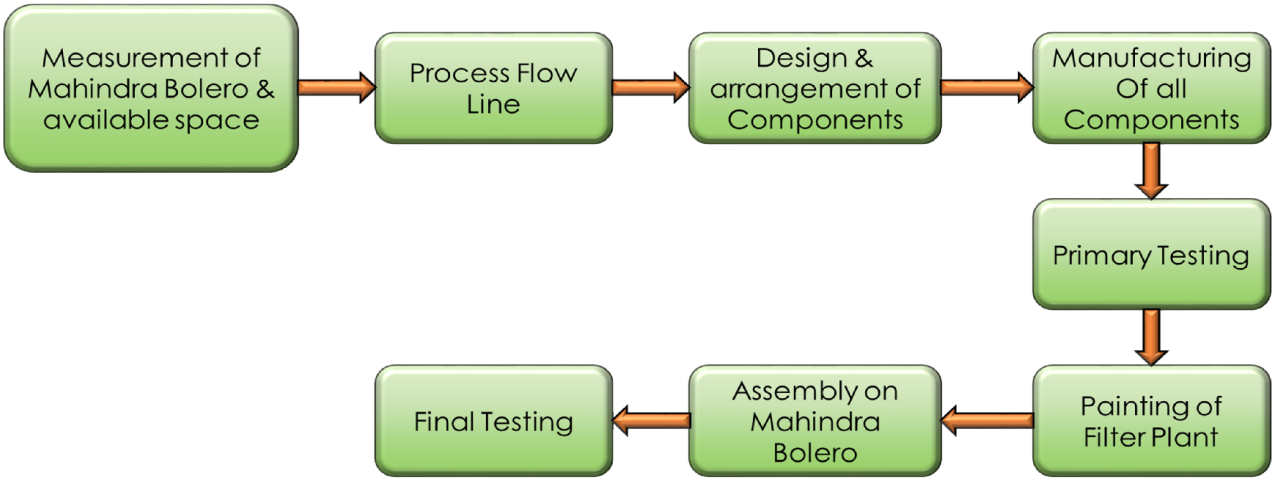
2 MANUFACTURING PROCEDURES

2.1 MACHINE DESIGN



Space available to use on Mahindra Bolero is measured and accordingly it is designed by using software of Auto CAD.

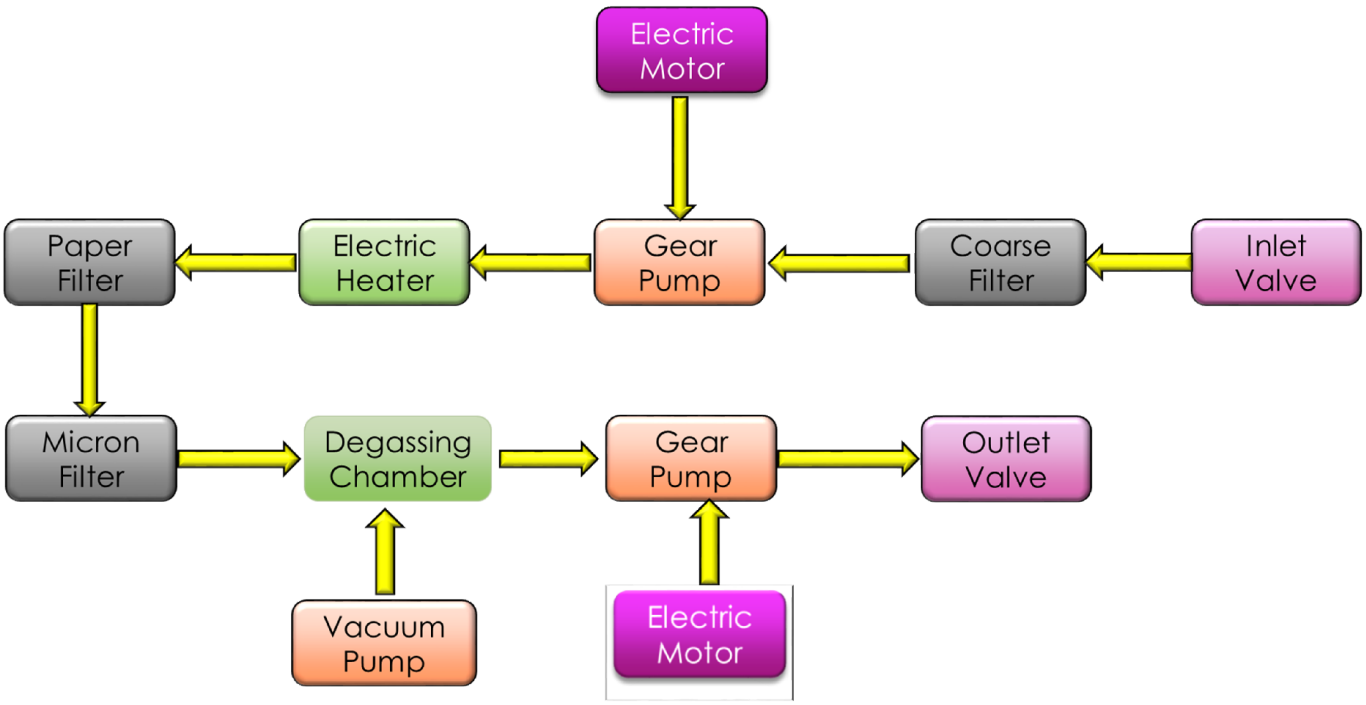
2.2 METHODOLOGY



2.3 SPECIFICATIONS

- Maximal oil flow rate 300 l/h
- Heating capacity 7.5 x 2 Kw
- Adjustable oil temperature range 40 °C – 100 °C
- Differential temperature (inlet/outlet) approx. 28 °C
- Minimal oil inlet temperature 5 °C
- Vacuum pump capacity 17 m3/h
- Filter fineness 2 microns
- Total power 16 kW
- Final oil qualities, after five passes:
- Water content - 2-4 ppm
- Gas content - 0.05 % Volume
- Operating pressure in degassing tank 2 - 9 mbar.
- Unit, size 1500 x 600 x 1200 mm.
- Unit, weight approx. 400 kg.

2.4 PROCESS FLOW LINE



3 TESTING AND RESULTS

3.1 BREAKDOWN VOLTAGE

The transformer oil characteristics before filtering:

- Dielectric strength of fresh oil before filtering - 50 kVA
- Oil amount taken for filtering - 500 l
- Capacity of the Unit - 300 l/h

The filtering process completed in four passes of oil through the Unit and the following results were obtained:-

	TOTAL AMOUNT OF OIL (Litres)	BREAKDOWN VOLTAGE ACROSS 2.5 mm GAP (KV)	MOISTURE CONTENT (PPM)
INITIAL CONDITIONS	500	10	50
FIRST PASS	500	30	35
SECOND PASS	500	52	24
THIRD PASS	500	64	10
FORTH PASS	500	78	3

3.2 COMPARISON

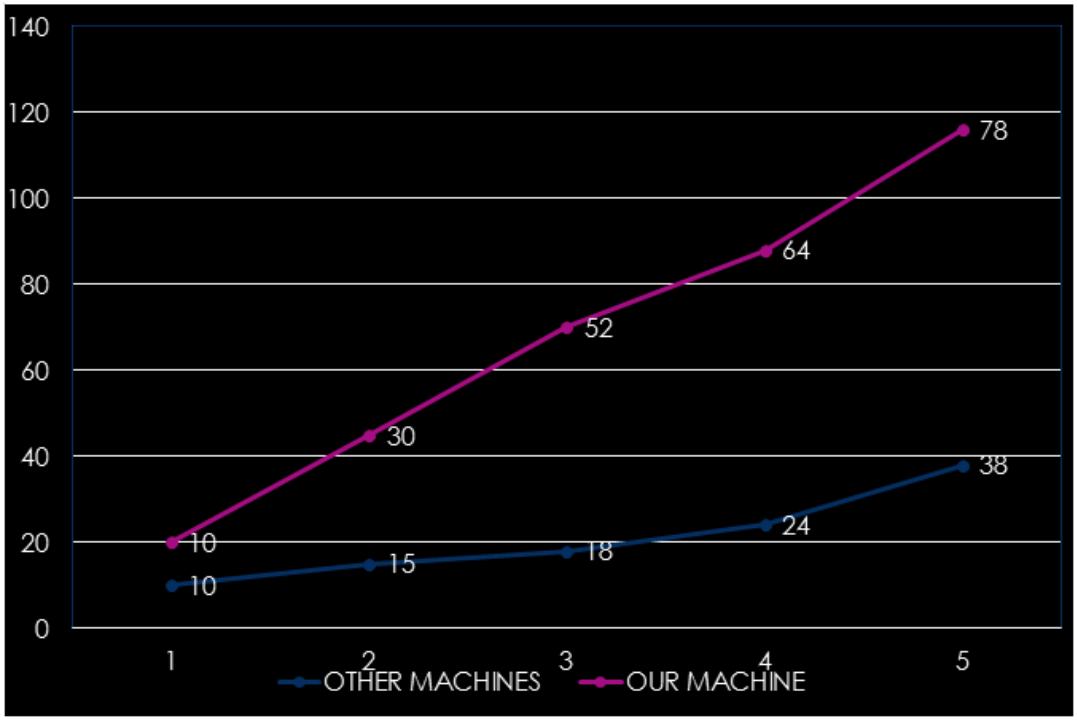
With other machine:

	BREAKDOWN VOLTAGE ACROSS 2.5 mm GAP (KV)	MOISTURE CONTENT (PPM)
INITIAL CONDITIONS	10	50
FIRST PASS	15	50
SECOND PASS	18	50
THIRD PASS	24	50
FORTH PASS	38	50

With other machine:

	BREAKDOWN VOLTAGE ACROSS 2.5 mm GAP (KV)	MOISTURE CONTENT (PPM)
INITIAL CONDITIONS	10	50
FIRST PASS	30	35
SECOND PASS	52	24
THIRD PASS	64	10
FORTH PASS	78	3

3.3 GRAPH OF COMPARISION



4 CONCLUSIONS

The cost effective and mobile transformer oil filter plant is manufactured. With degassing of oil.

The main conclusions of this study are as follows:

1) Degassing of transformer oil is easily possible with the help of vacuum pump.
2) The Moisture contents are reduced by 94%.

REFERENCES

[1] D.K. Systems Pvt. Ltd. Bhosari, MIDC, pune.