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Consulting Electrical Engineers Association of Maharashtra

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From the President's Desk

Dear All,

Greetings from CEEAMA Governing Council (GC).

After successful CEEAMATECH-2018 – we are glad to announce CEEAMATECH-2019, Three day Exhibition at Pune. We have signed Memorandum Of Understanding (MOU) with FAIRACT, as our partner for next three Exhibitions at Pune.

We are glad to inform you that we are receiving good amount of appreciation about CEEAMA-E-News.

Seminar on "Electrical Safety & Energy Conservation in Buildings", organized jointly by International Copper Association (ICA) and CEEAMA, was very much Informative and appreciated by all participants. We are thankful to ICA for all the efforts taken by them for making the seminar most fruitful. During the seminar we had interaction with Government Authorities, in connection with recognition of consultants, during Design and implementation stage. It was emphasized by the authorities that, consultant shall be recognized and held responsible, for the design; as the contractor is implementing the design by consultant. We will take this further and hope to proceed in right direction, in getting recognition as "consultant" officially in government procedures.

CEEAMA activities are increasing and we are expecting more active participation from our members. We once again appeal our members to give a thought and come out with suggestions on new initiatives to be taken to increase the visibility of CEEAMA, in Industry.

Monsoon is coming up. In line with our focus on Safety, request all of you to insist on Electrical Safety Audits in your premises to avoid any mishaps during monsoon, due to electricity. Do ensure to test functioning of your ELCBs.

Wish you all Happy and Safe Monsoon

Thanks & Regards,

Anil Bhandari
Hon. President

In This Issue...

CEEAMATECH-2019

LAUNCH EVENT

We are pleased to announce that we have launched CEEAMATECH 2019 Exhibition, the 7th Edition in the series of CEEAMATECH Exhibition and Conference as on 2nd June 2018. Event took place at Hotel Deccan Rendezvous, Pune with presence of 35 Key Dignitaries from Electrical Industry with CEEAMA Directors.

Event started with Speech from our Hon. Secretary Mr. Suhas Keskar, followed by CEEAMA Presentation from our Hon. President Mr. Anil Bhandari. And then detailed presentation on CEEAMATECH 19 by Mr. Ganesh Parker from FairAct. (Event Partner).

The CEEAMATECH will showcase more than 100 exhibitors presenting the latest trends and innovations in the electrical sector for the benefit of the Industry visitors Over 3500.

Some Glimpse from the Event



Technical Notes

What is loose contact?

Loose contact is a condition which occurs when the wire is loose in the terminal, or a plug sits loose in the socket, or a screw is loose in a connection. These are valid in LV circuits.

While in MV & HV circuits, loose contacts can be due to cables

becoming loose in lugs, bolts holding lugs on to the terminal becoming loose, or a circuit breaker with its male & female contacts becoming loose, or a aluminum cable terminations in a copper lug becoming loose.

The list is endless both in the LV circuit & HV circuits.

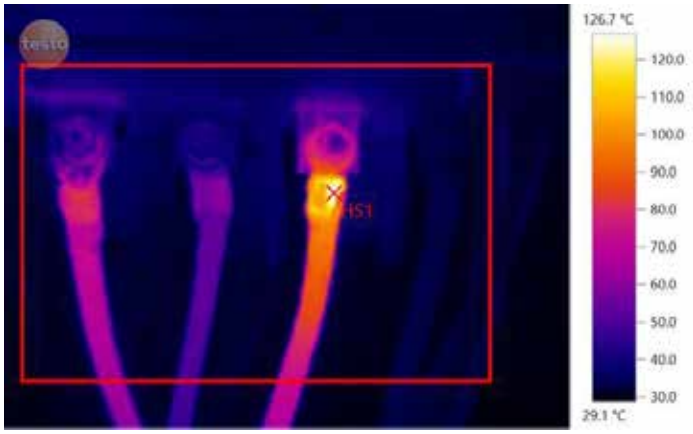
How serious are we in detecting loose contact in LV domestic or commercial circuits? These go un noticed as the consumers may not be technically competent to notice the initial tell tale marks of loose contact , in the form of localized heating, or discoloration of plug & socket, or discoloration of wires carrying current. Practically no one undertakes maintenance of these circuits till a healthy equipment fails to perform its duty in the circuit.

Periodic maintenance carried out by Industries using MV or HV supply can deduct loose contact and take corrective steps. The best tool available is to measure Contact Resistance, of the circuit using a bridge delivering high DC current of the order of 100amps. Contact measurements are carried out for breaker, terminals, bus bar connections among others. The results expected are in micro ohms, higher results indicate loose contact.

Thermal scanners are an important tool for measuring hot spots when the circuit is energized.

To summarize, A loose contact can produce:

1. Spark b/w cable and equipment.
2. Damage of cable lugs.
3. Heating of any insulation nearby.



4. Can ignite any inflammable material near by
5. Voltage reduction b/w the terminals etc.

Loose connection is the most Dangerous thing in electrical engineering and one should always avoid it.

Due to loose connection the contact resistance will increase and when the current flows through it, it will start heating at the connection point and if the current continues the contact point may melt and disconnect the supply.

Some commonly known defective wiring practices that can lead to Electrical Fires include:

- Loose connections.
- Aluminum and copper conductors spliced together with an incorrect connector. Aluminum oxide causes overheating.
- Some insulation piercing connectors when applied incorrectly can make poor connections due to insufficient contact area or pressure.

Prepared by:

A V Prasanna

Ceeama Activities

National Seminar on "Electrical Safety & Energy Conservation in Buildings" Mumbai

The National Seminar on Electrical Safety & Energy Conservation in Building was held in Mumbai on 25th May 2018, organized by the International Copper Association India in association with Consulting Electrical Engineers Association of Maharashtra (CEEAMA), Bureau of Indian Standards(BIS), Central Electricity Authority (CEA), Bureau of Energy Efficiency(BEE) and Chief Electrical Inspectorate.

The overall objective of the Seminar was to enhance Electrical Safety & Energy Sustainability drive amongst key constituents of building industry and industry stakeholders, through nationwide awareness campaign. Key provisions in NBC and ECBC, especially electrical area, under National Regulatory Guidance and Practices thereof are deliberated.

The National campaign brought together professionals associated with state electrical safety implementation bodies like Chief Electrical Inspectorates, State Public Works Department, Central Public Works Department, and State Designated Agencies under Energy Conservation Act besides experts from Distribution utilities of Central, State & Private Sector under one roof.

Key Dignitaries:

Mumbai:

- Special Address by Shri. Anil Bhandari, Hon. President, Consulting Electrical Engineers Association of Maharashtra (CEEAMA)
- Inaugural address by Shri. S R Bagde, Chief Electrical Inspector, Govt. of Maharashtra.

Tech Session:

- Electrical Accident Analysis, Issues and Challenges by Shri. Karthik Vagicharla, Assistant Director and Shri. Sandeep Kumar Assistant Director CEA.
- Electrical Safety inspection in high rise building by Smt. Meenakshi Wathore, Electrical Inspector, Govt. of Maharashtra.
- Smart Connected Power Distribution by Shri. Rajkumar Singh, Director, Technical Marketing, Schneider Electric.
- Protection against Electric Shock & Electrical Safety in High Rise Buildings by Shri. Amitabha Sarkar, Member ET20, BIS.
- Lightning Protection & Earthing in buildings as per IEC 62305 & NBC 2016 by Dr. K Janakiraman, Sr. Manager, OBO Betterman.

Some Glimpse from the Seminar

Article

Moisture Management systems in Power Transformers – A need of the hour

Introduction

Power and distribution transformers are the most important and expensive assets in an electrical power network. Compared to other equipments, they are very reliable and require very little maintenance since they have no continuous moving parts. However, the insulating paper material, being organic will degrade with time, and thereby cause damage to the transformer.

Water is a by-product of the decomposition of the long chain hydro-carbon glucose molecules of cellulose that makes up the paper and pressboard insulation. Excessive moisture will saturate the insulation and increase its conductivity.

At higher temperatures vapour or free moisture can develop increasing the high risk of partial discharge and flash-over faults. Moisture has a great influence on the life expectancy and the load carrying capacity of a transformer. Moisture reduces the electrical and mechanical strength of the solid insulation. In general, the mechanical life of the insulation is halved for each doubling of the ppm water content; the rate of thermal deterioration of the paper is directly proportional to its water content.

The design life of power transformers is usually 30 to 35 years. In fact the typical Time to Failure of a large generator transformer (working at constant full load) is 18 to 24 years and a transmission or distribution transformer (working at half load or less) can be 40 to 60 years. The actual life of a transformer is determined by ageing of the cellulosic insulation in the form of paper on conductors and leads, and of pressboard used for inter-turn or intersection spacers. The insulation life is determined by three factors:

- Operating temperature
- Access to oxygen
- Water absorbed in the paper.

As cellulose ages the length of the glucose chain slowly reduces due to chain schism from 1200 molecules to about 200 molecules when it no longer has sufficient mechanical strength to be viable.

Operating temperature

Unless redundancy has been built into the transformer rating at the specification stage, a transformer is always likely to operate at or near the rated value. For every 6.5º C increase in operating temperature the insulation life will halve, based on moisture content in the paper of 0.3% by weight.

The remnant life of the transformer will be reduced whenever it is operating at high temperature. The rate of ageing will be higher (up to 50 times faster at moisture contents of 5% in the paper), and the remnant life will be much reduced.

Oxygen

Ageing is due to chemical reactions between the long-chain glucose molecule of cellulose and oxygen. With no oxygen present there can be no ageing of the paper, but oxygen is always present either as air dissolved in the oil or as water in the oil or paper. Attempts to replace air in the oil by nitrogen or an electro-negative gas have always failed, but a rubber-based membrane has been used with success to prevent direct contact between the oil and the atmosphere. Unfortunately the material of the membrane has a lifetime of only 10 to 15 years before is begins to allow air and water vapour to diffuse through it. In addition, water at up to 10% of the weight of cellulose is formed by the chemical process of ageing. Fitting a membrane will trap water formed during this process and moisture is locked into the system where it is a catalyst causing more rapid ageing of the insulation.

Water

Under normal conditions oil will dissolve 60 ppm water before it saturates. Cellulose saturates at 10% water content when it is dry and between 12 and 18% water content when it is oil-impregnated. The presence of moisture as a contamination in the oil-paper insulation system will compromise the dielectric strength of the paper and will act as a catalyst for rapid ageing of the insulation system. Moisture can enter the oil-paper system in several ways:

- It can remain absorbed in the insulation if the factory drying process has been inadequate.
- It can enter the transformer during service if the air drying system has not been properly maintained, diffuse through gasket material or enter through cracks in the tank (welding defects).
- It can enter through openings in the tank if the internal insulation has not been correctly protected during site erection operations or during service outages.
- In addition, water is generated internally in the transformer as the paper and pressboard materials age in service. The rate of ageing in service is accelerated by operation at high temperature, by the presence of oxygen as air dissolved in the oil or as water in the paper.

Mitigation to reduce ageing

The traditional means of protecting the insulation system of a transformer from the ingress of water is to fit a silica gel breather. These breathers need to be maintained as often as every two weeks and do not remove moisture generated inside the transformer by ageing of the insulation.

Refrigerated breathers based on Peltier devices are widely used to continuously remove water from oil in the conservator. These devices will slowly remove water from the cellulose insulation but are ineffective when water in the paper exceeds 2.5% by weight.

Oil filtration plant based on heat and vacuum operations are effective in drying the oil, but as more than 99% of the moisture is absorbed in the paper, it quickly migrates into the oil and the oil remains wet.

Molecular sieve drying devices are connected to circulate the main tank oil over a charge of molecular sieve material; this is a naturally occurring zeolite selected with a 4 Angstrom pore size to match the size of a water molecule. Water is trapped at up to 40% by weight of molecular sieve material through chemical bonding, and can only be removed by a heat and vacuum process to break the energy bonds holding water in the material.

Molecular sieve drying devices can be used to slowly remove moisture from the cellulose insulation by removing water from the oil. The movement of water from cellulose to oil takes place at the same rate as the movement of water from oil into the molecular sieve material. High levels of moisture have been removed from the insulation of transformers over a period of weeks and months to reduce the risk of the transformers failing due to electrical surges or through mechanical faults associated with high through-fault currents.

An alternative water management scenario is to fit molecular sieve devices to new transformers, in combination with refrigerated breathers or diaphragm seals. The molecular sieve device absorbs water dissolved in the oil and removes water produced by degradation of the cellulose as it is formed. This combination of devices is effective in maintaining high integrity of the transformer insulation by eliminating the main catalyst for ageing and avoiding a reduction in the dielectric performance of the insulation structure.

TRANSEC – ONLINE MOISTURE MANAGEMENT SYSTEM

TRANSEC is an on-line molecular sieve, developed and manufactured in the U.K and now manufactured in Facility if Ravin Group under licence from Transec- U.K.,

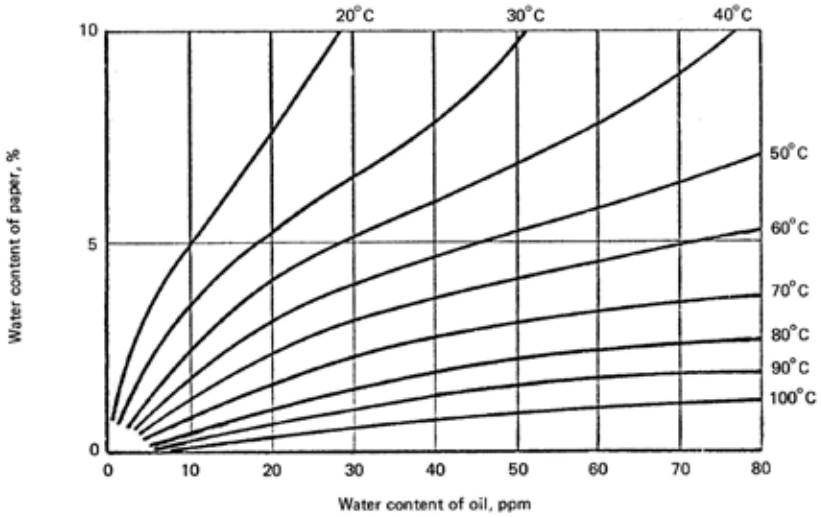
Transec will continuously remove water from the oil and from the paper insulation in a power transformer while it is fully operational. This on-line process not only reduces ageing, but will improve the dielectric strength of the oil, and increase reliability. Plumbed into the oil 'circuit' of a transformer, the circulation pump will pump the oil across the molecular bed, which, through chemical bond, will attract water particles contained within the oil. By constantly reducing the level of water contained within the oil, water contained within the solid insulation, where over 95% of the water is trapped, will migrate into the oil to maintain the natural water equilibrium. In this way water gradually moves from the solid insulation, to the oil, and then trapped by the molecular sieve.

A 10 micron particulate filter will at the same time remove extraneous matter, such as fibres, which can become ionised, being attracted to areas of high electrical stress and causing a flashover. TRANSEC is designed to be a slow, non-invasive, gradual process, that will by lowering the ppm level of water in the oil, encourage water to migrate from the solid insulation to maintain the natural hydrostatic equilibrium, and hence over a period of time, significantly reduce the water contained within the solid insulation, and therefore reduce the rate of ageing, extending the life of the transformer.

The TRANSEC system has the capacity to remove approximately 10 litres of water from a transformer before saturation, but the rate at which it will adsorb water will depend on many factors, mainly, how much water is available in the oil, and the temperature range through which the transformer will operate. The design flow rate of the pumped oil is nominally 90 litres per hour to give maximum adsorbtion through the molecular bed. The oil temperature does not have to be elevated to give optimum adsorbtion. A single TRANSEC cylinder will adsorb approximately 30% of the weight of the zeolite material giving a theoretical volume of 3.9 litres. of water. The rate at which this adsorbtion takes place is dependant on availability of water, temperature, and the % saturation of the cylinders, the process will slow as total saturation is reached. The Isostere graph shows that the adsorbtion performance of the zeolite improves with a reduction of temperature, whereas other dry out devices require elevated temperature to allow effective dry-out. However, we know that the higher the temperature of the transformer, the faster the rate of ageing of the paper insulation material. Typically a CL3AM on a wet (insulation water content 4% by dry weight) hot transformer operating in a hot humid ambient climate might saturate in 6 to 9 months.

A CL3AM on a dry (insulation water content 1% by dry weight) operating at 50° C might take 24 months to saturate. A CL3AM on a brand new transformer (insulation water content 0.3% by dry weight) might take 5 years before saturation. No specific claims for ppm levels in oil are made by TRANSEC, as the reduction of ppm will always depend on the 'wetness' of the transformer, and the dynamic operating conditions. The product is judged on the amount of water that is removed, which is reported to the client

when the cylinders are replaced and regenerated.



Possible figures to support text

Figure xx Increased rate of ageing of cellulose with water content

REGENERATION

When the cylinders are found to be saturated they must be replaced. TRANSEC (UK) offers a cylinder exchange where we supply three previously 'regenerated cylinders' for either the client, or TRANSEC to fit in

place of the existing ones. This is done by simply using the quick fit couplers on the top and bottom of each

cylinder, and removing each cylinder in turn. The couplers self seal, so there is no oil loss. The three replacement cylinders are then fitted and the quick couplers snapped shut. At the same time the particulate

filter should also be changed. The 'wet' cylinders removed are then returned to TRANSEC (India), who will carry out the regeneration process. Method statement TR003 must be observed for the cylinder change process. (available on request)

MATERIALS & PERFORMANCE SPECIFICATION

Product: TRANSEC CL3AM On-line Transformer Drying Unit with Monitoring

ADSORBTION MATERIALS & PERFORMANCE:

Zeolite - Crystalline Aluminoscilicate with binders (CAS-No. 1318-02-1; EINES-No 215-283-8)

3 Anstrom bead size. Non-flammable and bio-degradable.

Weight of beads per cylinder - 13 kgs

Oil Volume per cylinder - 12 litres

Oil Type - New un-inhibited napthynic to IEC 60296 (3)

Adsorbtion capacity of water per cylinder - Maximum 30% of bead weight (3.5 litres – approx 10 to 11 litres total for 3 cylinders per cycle)

MATERIALS IN CONSTRUCTION:

Cylinders: 304 grade stainless steel all welded construction with quick fit couplers for ease of removal.

Frame: 304 grade stainless steel all welded construction.

Pump: Caned Rotor sealed circulation pump running at average 90l/hr -25ºC to 110ºC

Pipework: 15mm x 1mm wall Stainless Steel seamless tube with all welded joint construction wherever possible.

FITTINGS: Stainless Steel ¼ turn ball valves, flow indicator, de-aerator, non return valves etc. Lockable air bleed valve, accessible at ground level on 6mm diam. copper– upto 5 m capillary tube Non- return valve, ½" BSP, brass body construction.

MONITORS: Vaisala MMT 162 probes at input and output for SCADA signal for oil temperature

and ppm water in oil, with local LCD display.

LEM monitor for incoming LV supply and pump integrity.

INSTALLATION Typically for CL3AM mounted on transformer:

MATERIALS: 2 x 1.5m length of 15mm stainless steel pipe

2 x Flange Adaptors – 15mm pipe to take off valve flange size.

4 x ½" BSP M x 15mm SS male stud couplings.

3 x ½" BSP M SS hex nipples

TYPE TESTING: Random unit selected for test once every 12 months.

System pressurised to 3 bar for 1 hour at 110ºC (pump not running) to prove leak free.

ROUTINE TEST: Every production unit.

Each individual cylinder is tested under 4 bar pressure prior to TRANSEC unit assembly

Each unit is tested pressurised to 2 bar for 30 minutes at 60ºC to prove leak free.

Contributed By

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