ഊർജ്ജ സംരക്ഷണം ശീലമാക്കുക.

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MERRY X'MAS & HAPPY NEW YEAR

WISHES TO ALL

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Members are requested to give articles to the Power Scene either to the Editor or the Area Representatives. Articles from family members are most welcome. Articles may also be mailed to **ksebeakottayam@gmail.com**

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K.S.E.B. ENGINEERS' ASSOCIATION,KOTTAYAM UNIT

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CHAIRMAN's COLUMN

Er C.P.George, DyC.E., Electrical Circle Pala

Dear Engineers,

ENFORCING ELECTRICAL SAFETY FOR PUBLIC:TECHNICAL REQUIREMENT FOR THE DISTRIBUTION SYSTEM— Recently KSEB received some directions from the Civil Authorities and Legal Forums including the honourable Human Right Commission to device mechanism to ensure that the snapped conductor are electrically harmless to enforce the safety to the Public and Animals. Based on the above direction KSEBL has made so many top level discussions and yet to make a consensus on the action plan to comply the directions which is actually in tune with the regulation 73 of the CEA safety regulations 2010 ….!!

In this back drop we need to read and analyse the higher rate of electrical accident in Kerala System, the reluctance of KSEBL to enforce mandatory standards and the present alarming state of affairs in the safety environment in the distribution sector. We need to know that the shortcuts will not provide the desirable results and need to tackle the real issues that are being are faced by us to improve the safety environment of our system.

Actually it is a state of grave concern that KSEBL received such a direction from Legal Forums and Civil Authorities concerning the safety of the public. Again it is pity that we are still under the state of discussion regarding the option to ensure that the line is electrically dead automatically on snapping, when there are specific compliance requirements mentioned in the mandatory regulations to ensure the same. Actually we are still searching for shortcuts when there are clear cut mandatory provisions to act upon to solve the real issues facing the system regarding safety and performance. Actually the directive is an indication of the state of affairs in our organisation and the extent of dilution of the safety standards and construction standards done by us which lead to the present pathetic state of affairs of our distribution network.

We need to know that most of these provision were there even in the erstwhile IE rule 1956 and same has been continued to the CEA safety regulation 2010. One such important provision was rule 91 of the erstwhile IE rule 1956 and now retained as regulation 73 in the prevailing CEA safety regulation

2010.

Accordingly "Every overhead line which is not being suspended from a dead bearer wire, not being covered with insulating material and not being a trolley-wire, is erected over any part of a street or other public place or in any factory or mine or on any consumer's premises **shall be protected with earth guarding for rendering the line electrically harmless in case it breaks or in any factory or mine or on any consumer's premises shall be protected with earth guarding for rendering the line electrically harmless in case it breaks."** And we know that such a provision is not complied by KSEBL so far, though many of our neighbouring states and licences have complied it long ago….!

As every power engineer is aware of the fact that to render a snapped conductor electricity harmless, we need to have a protection system which shall isolate the supply from the source. This protection system includes a simple kit-kat fuse to the most modern circuit breaker in the system. All these equipment ensures the isolation of the downstream supply, in case it sensed a fault according to the pre-set value and design. Generally these protection system acts based on the technology and principle of

1. over current

2. earth leakage current

3. the variation of the impedance/ electrical property of the of the OH line conductor

We need to know that for **LT & HT, the proven technology for protection is "over current" and "earth leakage"**. Thus regulation 73 of CEA

safety regulation 2010 is of greater importance in ensuring public safety in our electricity distribution system. The compliance of regulation 73 shall ensure better clarity in tripping signals and ensures the isolation of the downstream supply with far better reliability. It is noted with great regret that inspite of all these great talks and discussions and directions, we have not even considered the enforcement of the relevant provision in the mandatory CEA safety standards to ensure a better safety environment for public from our system. Over the period, we have diluted the construction standards of the distribution network and particularly, the provisions in the "**system of grounding**" in the CEA construction and safety standards to such an extent that the relevance of proper grounding have least importance in the distribution works….!!

Recent electrocution of Three Tribal woman at Mankulam, near Adimaly again brought up the issue of noncompliance of regulation 73 of CEA safety regulation 2010 and it is learnt that, Board has decided to go for better sensitive digital relays for all 11kV feeders emanating from the substation. When we are thinking of sensitive relays at s/s of 11kV feeding end, we need to know that, for an earth sensitivity less than 5% of the load current, we need to have a well maintained the ROW of 11 kV lines to avoid nuisance tripping. To ensure the minimum value of the pre-set value of tripping signals (earth leakage current) we need to comply regulation 73 of CEA safety regulation 2010. Again to ensure that the feeder length and transformer capacity in the feeders shall ensure a fag end regulation less than 8% as recommended by REC standards. Kindly note that to ensure such a regulation at fag end of the feeder, the maximum KVA-KM allowed in the feeder with Raccoon conductor is 16800 @ 0.9 system power factor, which means a feeder length of less than 8 km @ 200 amps (max) or less than 30 x 100 kVA transformer @ 70% load…!

Conclusion.

1, To ensure better electrical safety for public from our system, we must ensure compliance of the mandatory construction and safety standards specified by CEA.

2,The dilution of the safety standards and construction standards over the years have resulted in deterioration of the distribution system and need to regain the standards with extra efforts and special drives.

3, Quality of grounding and the system of grounding is the most important factor in ensuring public safety which increase the reliability of the protection system that ensures the snapped conductor electrically dead immediately on snapping. Hence extra efforts need to be made to ensure a reliable system of grounding in compliance with the relevant provisions in CEA construction and safety standards.

LIFE ASSESSMENT OF TRANSFORMERS

Power transformers and Generators are key components in any transmission& distribution network and los of a Transformer and Generators can have an enormous impact on reliability and availability of power supply and on cost. As society is more and more dependent on electricity for development, the utilities are under pressure to meet the ever-growing demands for reliable power supply. Economic factors are the main consideration and in order to minimize capital expenditure on new equipment, it is a common policy among utilities to maximize the use of existing networks by operating at their design capability. This can be achieved by according importance to the maintenance practice. A survey of the literature indicates that there are more failures of transformers 'and generators are due to poor maintenance, improper operation, severe weather conditions and manufacturing and design defects than due to insulation ageing. The utilities shall have a systematic O & M practice that includes diagnostic tests for condition assessment and health check up of the equipment. The objective of the condition monitoring tests is to detect the first symptoms of incipient faults, ageing development or other problems and monitor their evolution to enable the operator to take appropriate action to avoid major failure. The paper reviews the results of various diagnostic tests including dielectric response methods for condition assessment of power transformers.

Condition monitoring of power transformers has been a continuous process and has seen many improvement over the years. Although several diagnostic tests such as dielectric los angle, IR/PI, DGA, furan analysis are available, interpretation of data still appears to be a challenging task [1, 2, 3, and 4]. Interpretation of data requires care and experience. In recent times dielectric response methods have been introduced for

detection and determination of moisture content and ageing of press board/paper insulation system of power transformers [5, 6, and 7].

Moisture in the transformer affects the dielectric strength and the rate at which the insulation ages and in some cases, there is also threat of bubble evolution above a certain temperature when the load is suddenly increased [8]. Presently, the water content of the cellulose of a transformer in service is determined indirectly by measuring the moisture content in the oil sample. The moisture distributes unequal y between the oil and pressboard, the greater part residing within the solid insulation. As the water concentration in the oil is highly temperature dependent, the measurement of moisture in oil is not a reliable indicator of dryness of the cellulose [7]. In addition to the conventional measurement of power frequency los angle, recent attention has focused on measuring various dielectric response parameters, which characterize some known polarization phenomena. Many testing agencies in Europe have adopted these test methods and data are being generated to study the efficacy of the test in assessing the status of the transformer Insulation System.

CPRI has been carrying out variety of condition monitoring tests on power transformers in service for over 20 years. These tests include insulation resistance, dielectric los angle, capacitance, partial discharge (PD), winding resistance, TTR. The dielectric response methods such as recovery voltage measurement and dielectric spectroscopy methods have also been adopted by CPRI for comprehensive diagnosis of health status of power transformers. These new techniques have been found to be effective in monitoring moisture dynamics in paper-oil insulation system. These diagnostic tests become significant and valid only when they are sensitive to the changes in the electrical properties of the insulation system. Since each parameter can be related to certain information on the status of the insulation, it is essential to carry out several tests to get a real feel of the insulation condition.

STRESSES ACTING ON POWER TRANSFORMERS:

The major stresses acting on the windings of a power transformer either individually or in combination are the following:

Mechanical stresses between conductors, leads and windings due to over currents or fault currents mainly caused by system short circuits.

Possible variations of supporting parts of the winding or core may also cause deformation of the windings or of the cleats or leads. There can be collapse of the windings also. The deformation distortions in the windings cause changes in the geometrical distance of the windings, which in turn cause changes in the winding inductances and internal capacitance. Thermal stresses due to local overheating overload currents and leakage flux when loading above nameplate rating or due to malfunction of the cooling system. Local hotspots, loose joints etc can give rise to high thermal stresses. Severe partial discharge resulting in arcing is another possibility. Dielectric stresses due to system over voltages, transient impulse conditions or internal resonance within a winding. These stresses cause deterioration of physical and chemical properties of the transformer insulation. The situation is more complicated due to the fact that dielectric failure is often and final stage consequent to the mechanical and/or thermal stresses especially if moisture and oil deterioration have already placed the transformer in a hazardous condition.

<u>Insulation resistance measurement:</u>

The IR is the elementary test practiced by all the maintenance engineers for testing of HV equipment. It reflects the moist/ contaminated condition of the insulation. The IR will be usually high (several hundred Mega ohms) for a dry insulation system. The maintenance engineers use this parameter as an index of dryness of the insulation system.

IR is generally accepted as a reliable indication of the presence or absence of harmful contamination, dirt, moisture and gross degradation. Typical values of IR of transformers, sometimes, are identified by utilities, consultants and manufacturers. However, these are not reliable, as IR measurements are sensitive to changes in temperature, humidity, external leakage due to dirty insulators and bushings, duration of test etc. However Polarization index (PI) can be used as index of dryness of the insulation. It is the ratio of ten minutes IR value to the one minute IR value. It is independent of temperature as it is the ratio of two IR values. IEEE STD 62-1995 gives the following guidelines for evaluating transformer insulation on the basis of PI.

PI	Insulation condition
Less than 1.0	Dangerous
1.0-1.1	Poor
1.1-1.25	Questionable
1.25-2.0	Fair
More than 2.0	Good

(cont..)