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## Face to Face

The non-production of CRGO locally is a major challenge for the Lamination Industry: Mr Saif Qureishi

## Interaction

Growth in Transmission Network will promote growth in requirement of Power Transformers: Mr Nitin Naik

## Guest Article

Emerging Trends in Power Transformer: Dielectric Technology

## International Exposure

IEEMA signs MoU with BEAMA  
IEEMA Pavilion at Hannover 2017  
5th International Istanbul Smart Grids and Cities Congress and Fair

# POWER TRANSFORMERS

ANNOUNCING ELECRAMA-2018, 10-14 MARCH 2018



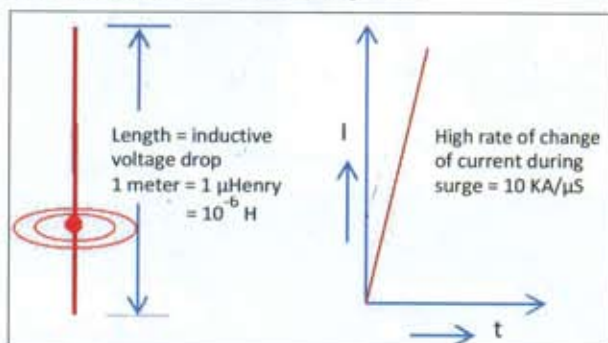
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## Application of HT Surge Arresters to Transformers

Surge Arresters are used to Limit the surge voltage much below the voltage impulse withstanding level of the near by apparatus and to divert Lightning current. The function of the earth conductor is to provide a conducting path over which the surge current can be diverted around the apparatus being protected, without developing a dangerous voltage magnitude. In the presence of a changing current ( $di/dt$ ) there will be an inductive voltage drop developed along the earth conductor itself, which is additive to the voltage protection level of the surge arrester. The amount of this added voltage will be proportional to the conductor length, the spacing from the protected apparatus and the magnitude of  $di/dt$ . Actual values of  $di/dt$  range over wide limits, but a value of  $10 \text{ kA}/\mu\text{s}$  is representative. With such a rate of rise of current, even  $1 \mu\text{H}$  of inductance can be significant. The inductive voltage drop is proportional to the conductor length, the spacing from the protected apparatus and the magnitude of  $di/dt$ . Actual values of  $di/dt$  range over wide limits, but a value of  $10 \text{ kA}/\mu\text{s}$  is representative. With such a rate of rise of current, even  $1 \mu\text{H}$  of inductance can be significant.

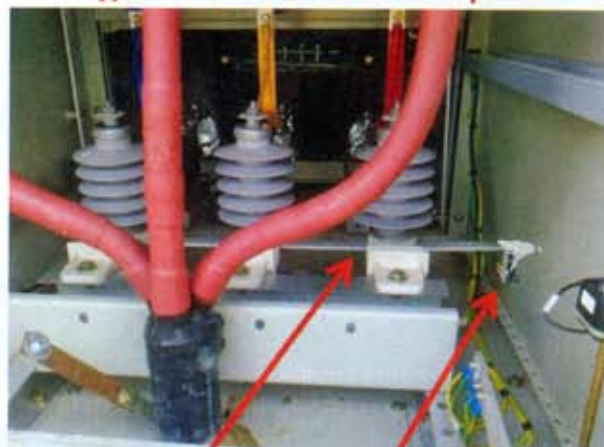


$$E = L \times di/dt = 10^{-6} \times 10\,000 \times 10^6 = 10\,000 \text{ V}$$

It would take only a 1.0 m length of  $95 \text{ mm}^2$  conductor spaced 1.50 m away from the transformer to add 10 000 V to the arrester voltage. Thus, grounding conductor length and spacing become of paramount importance. One can readily visualize that the additive inductive voltage is generated by the total flux linkages that can be developed through the window between the earth conductor and the protected apparatus.

Locating the arrester at any substantial distance, such as at the pole-top cross arm, with an independent grounding conductor can seriously increase the surge voltage stress on a transformer or switchgear by the voltage drop in the arrester down lead to ground. Arresters should be as close as possible to the equipment to be protected and to ground.

### Typical installation of S.A in a panel



Earth bus of LA. (insulated supports)  
Earth bus goes out of panel through an insulated rubber bushing

**Earth conductor of S. A connected to separate electrode**



Earth bus goes out of panel through an insulated rubber bushing

**Earth conductor of S.A in a pole**



Earth conductor of Surge Arrester insulated from the structure

Installations as shown in the pictures have separate, insulated earth conductor routed separately with out touching any metallic parts of structure to an earth electrode. This electrode is some time connected to grid.

**Conclusion**

Wrong installation practice are followed in some places due to which the intended purpose is not met.

The best solution is to mount the S.A as recommended in IEEE 142 at the body of Transformer. (ref. chapter 2, clause 2.2.7)

Alternatively, replacing insulated support to Metal support ensure connection between Earth wire and structure. The structure is connected to transformer body through earth grid (if not available, a connection need to be made). This change can protect the transformer to some extent. ■

**Mr S Gopakumar**  
 Managing Director of Cape Electric Pvt Ltd. He is also a member of National Building Code of India – Electrical Committee.

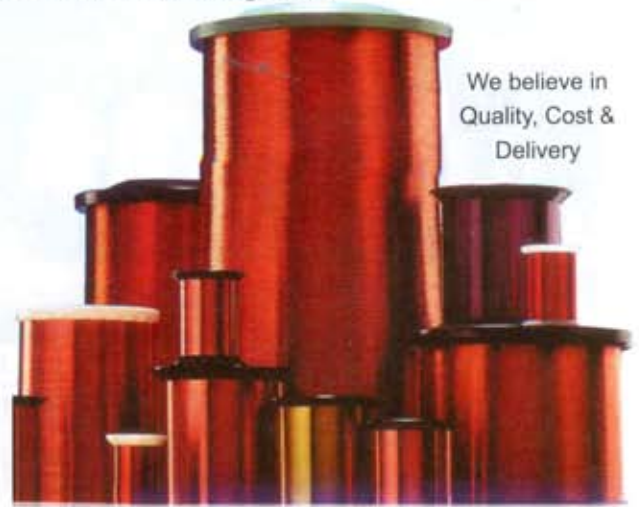


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