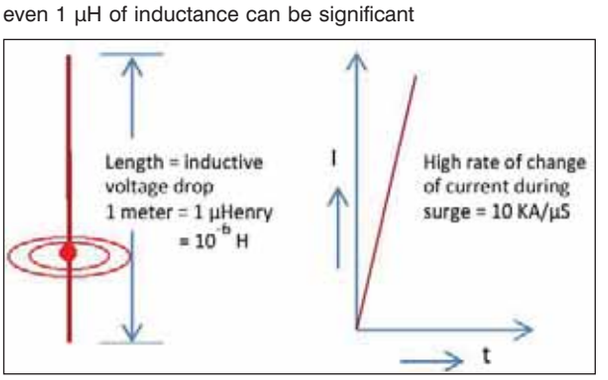
Application of HT Surge Arresters to Transformers

urge 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 kA/µs is representative. With such a rate of rise of current, even 1 µH of inductance can be significant be proportional to the conductor length, the spacing from the protected apparatus and the magnitude of d*i*/d*t*. Actual values of d*i*/d*t* range over wide limits, but a value of 10 kA/µs is representative. With such a rate of rise of current, even 1 µH of inductance can be significant



E = L × di/dt = 10–6 × 10 000 × 106 = 10 000 V

It would take only a 1.0 m length of 95 mm2 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 arrestor 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 arrestor 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 pats 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. ■

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