

ABSTRACTS of SESSION 7

Paper n°85

Positioning and coordination of SPD's in building

Abstract: The paper deals with the overall design of surge protective system within building. Positioning and coordination of multi-stages of voltage limiting SPD, also the protective distance were analyzed by ATPDRAW EMTP on PC. Two stages scheme with equipment built-in SPD is suitable for most of the building. Variants with equal or step up of voltage protection level of SPDs were favorable to coordination.

Keywords: Lightning protection, Surge protection, Surge protective devices, Coordination of SPDs

Paper n°87

Evaluation on protection distance of SPD to equipments in low-voltage distribution system

Abstract: The influence of the distance between surge protection device (SPD) and protected equipment was analyzed in this paper. The reflection and oscillation phenomena of transient voltage caused by the connecting cables were analyzed. This phenomenon depends on the characteristics of the external SPD, the protected equipment and the connecting cables between the SPD and the load. Three different loads and three different cable length have been simulated in this paper; the effective protection distances of SPDs for loads with different characteristics were presented.

Keywords: low-voltage power supply, oscillation phenomena, surge protection device, protective distance

Paper n°103

Simulations and measurements of lightning surges and shielding effect of telecommunication cables

Abstract: The paper addresses two important aspects of lightning on telecommunication systems: the coupling between the lightning discharge and a cable, and the grounding effect of the metallic cable sheath upon the resulting induced surge. The main features of a transient simulation program for the computation of lightning surges induced on the telecommunication system are presented. Measurements of actual lightning induced surges performed at a lightning experimental site are compared to simulation results. The correlation between the measurements and the simulation is discussed. The results show a very good agreement between the measurements and the implemented calculation methodology.

Keywords: lightning protection, electronic systems, telecommunication lines, lightning induced surges.

Paper n°104

The effect of protection procedures applied to telecommunication lines on the lightning induced surges

Abstract: This paper presents the experimental results of lightning induced surges on telecommunication lines, due to rocket triggered and natural lightning discharges. Simultaneous measurements were carried out in two identical lines, where one stands as

reference while protection procedures are applied to the other. The comparison between the measurements obtained for different line configurations allows the assessment of the effect of shielding, earthing and installation of SPD. The results were explained by transmission line theory and some simplified expressions to assess the effect of the protection procedures were developed.

Keywords: telecommunication lines, lightning surges, shielding, earthing, surge protective device.

Paper n°127

Experimental and computer simulation analyses of lightning effects on a telecommunications line

Abstract: The goal of this paper is to compare experimentally obtained lightning effects in a telecommunications line with simulated data. The experimental data were measured at the triggered lightning site at Cachoeira Paulista (Brazil) where several configurations of the lines were tested. The simulations were performed in the frequency domain and in the quasi-TEM assumption using a software based in the multiconductor transmission lines (MTL) with arbitrary linear networks exposed to plane wave disturbance or located generators.

Keywords: multiconductor lines, telecommunications cables, electromagnetic coupling.

Paper n°153

Transient behaviour of low voltage distribution system

Abstract: IEC and EN standards describing testing requirements for surge protective devices (SPDs) connected to low voltage power distribution systems emphasise the energy level that is expected to pass through each SPD type without giving much importance to the expected overvoltage levels. In high energy SPI technology, which is mainly based on spark gaps, the voltage protection level partly depends on the prospective overvoltage that will be applied across their terminals. In this paper a number of 3-phase low voltage distribution systems including the customer supply network are analysed. Energy and overvoltage levels are recorded for various case studies and the surge protection is evaluated for various methods/devices.

Keywords: Low voltage distribution system, SPDs, voltage protection level, lightning current distribution

Paper n°161

Influence of lightning, switching and temporary overvoltages on reliability of metal oxide varistors

Abstract: Surge overvoltages result in a power system from overcurrents due to atmospheric discharges, induction phenomena, switch operations or faults. In order to reduce the probability of failure of electrical and electronic systems within a structure, adequate equipotential bonding on the internal power system should be adopted. Surge protective devices (SPDs) are used to achieve such equipotential bonding. In the last decade, Metal Oxide Varistors (MOVs) have been the most used SPDs. Actually, MOVs are affected by ageing, due essentially to number and amplitude of stresses, but also to other factors such as overheating, pollution and humidity.

Aim of this paper is to present a method (reliability assessment), based on probabilistic arguments, to evaluate the ageing process of MOVs when lightning, switching and temporary overvoltages are sources of stress. The expected life thus obtained can be used to decide

(logistic/maintenance procedures) when the MOV must be changed before its failure occurs, since the main standards do not give definitive indications about such feature.

Keywords: Reliability management, Mean time between failures, Probability limits.

Paper n°169

Experimental investigations of protective features of selected surge protective device sets

Abstract: Intensive development of new technologies, which is nowadays widely observed, concerns mainly electrical and electronic devices and influences the conditions of lightning protection of contemporary structures. High level of sensitivity of these devices to lightning interferences requires very effective protection measures and their application according to the concept of lightning protection zones (LPZs). According to this concept the surge protective devices (SPDs) belong to the basic protection measures. Their efficiency depends on proper their selection and erection but it needs the knowledge of their detailed characteristics. To recognise them adequate experimental investigations have been undertaken and their results have been discussed.

Keywords: Lightning electromagnetic impulse, lightning protection zone, overvoltages, surge protective devices.

Paper n°177

Response of Surge Protection Devices to Fast Current Impulses

Abstract: In the present study, the behavior of few selected surge protective components for fast current transients is analyzed and compared with standard 8/20 μ S current impulses. The experiment was performed on disk type varistors and ceramic type gas discharge tubes (GDT). The result shown that, the clamping voltages due to fast transients for tested component is considerably greater than the one observed with standard 8/20 μ S current impulses. Further experiment was carried out to investigate response of series and parallel combination of surge protection devices.

Keywords: Fast current impulse, Surge protector devices, Lightning

Paper n°184

Varistors and Gas Discharge Tube Models - a Comparison Between Theory and Practice

Abstract: Surge protective devices (SPD) testing procedures are mainly performed with standard current pulse types. However, non of these standard current waveforms reproduce the very fast rise time and the large peak current derivatives observed in subsequent return strokes. In the literature there are several mathematical models to represent metal oxide varistor that have been developed based on standard impulse conditions. These models are being used routinely in EMTP type programs in the analysis of the various electronic circuits under transient conditions. In the present study two of these models have been analysed. The results showed that for a slow front impulse, these models had a good agreement with the experimental data. However, for current impulses into the sub-nanosecond range, further modifications to the models are required in order to improve their performance for this type of transient.

Keywords: Varistor, Fast front current impulses.

Paper n°197

Lightning protection of electronic systems connected with AC power sources and communication & control lines

Abstract:

The authors have practiced consulting for prevention of lightning damages to customers' equipments. From the contents of such consulting, most damaged equipments were those connected with communication & control lines. So, the authors have carried out experiments for evaluation of lightning protection method to such equipments by using a real scale simulated installation and an impulse generator. This paper presents the contents of consulting for lightning protection and the results of experiments for evaluation of lightning protection method to equipments connected with communication & control lines.

Keywords: consulting for prevention of lightning damages, lightning protection method, real scale simulated installation, impulse generator

Paper n°218

Maintainance test of surge protective devices- Testing the performance of surge protection devices

Abstract: Surge protection devices in electrical and electronical installations improve the availability of the equipment. But to be sure the right function of the protection device is existing, there have to be done continual examinations regarding their technical parameters. The check can be made internal in a surge protection device or external in use of test facilities. There are international standards which give informations about test performances and other demand the frequency of tests.

Keywords: Surge protection device, test performance, monitoring, fail save behavior, frequence of tests.

Paper n°228

Lightning impact on a telecommunication network: Prediction of the surges due to a direct lightning stroke on a tall structure

Abstract: The aim of this paper is to assess the level and the waveshape of the voltages generated on a telecommunication network by a direct lightning stroke on a tall tower. The frequency extended M.T.L. model associated to a simplified method to evaluate the reflection coefficients at the top and the bottom of the telecommunication tower, is used to predict the electromagnetic radiated field. In particular, it has been shown that the presence of the tower leads to a reinforcement in the first microseconds of the electric radiated field. As an example, for a typical telecommunication tower, such reinforcement represents about 60 % of the total vertical electric field radiated at a distance of 500m from the tower. This effect will also affect the waveshape of the voltages induced of a telecommunication line located in the vicinity of the tower.
