

SURGES — AN OFTEN UNDERESTIMATED RISK

Thunderstorms are fascinating and frightening at the same time. They are nice spectacles, but are a danger. Thunderstorms do not only indicate a change of weather, but are a threat to industry.

Protection against the damage from a thunderstorm is not a luxury, but a necessity, especially for sophisticated equipment.

Without protection, the effects of a thunderstorm can paralyze IT and power systems. Loss reports from insurance companies show clearly that there is a backlog demand both in the private and commercial sector. Approximately 24 out of 100 cases of damages are caused by surges.

However, it is not only lightning which can cause destruction or interferences of sensitive electronic equipment. Even a low peak voltage at the power supply can often be sufficient. Surges can also occur during operational switching of great loads or uncompensated inductances, causing damage even from a distance.

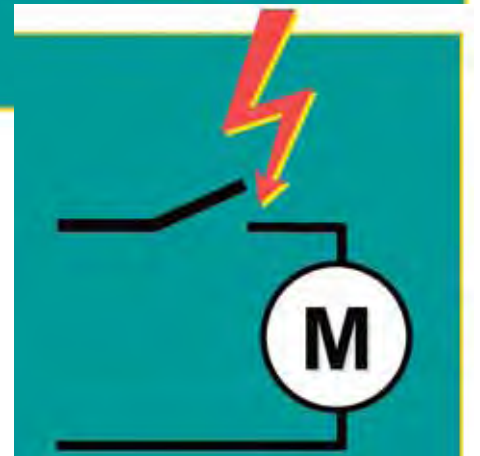
Only split seconds are sufficient to cause complete chaos in a company, especially if surges have been underestimated.

In fact, the number of lightning activities is increasing. The city of Toronto has, on average, 200 flashes a year per 100 sq km, Hamilton 191, Windsor 251, et cetera (Source: CLDN; Canadian Lightning Detection Network).

PROTECTING PERSONAL VALUES

Modern homes are filled with electronic equipment. Although surges are fatal for devices and systems, values of several 10,000 of dollars are still left unprotected.

Not only TV, stereo and satellite receivers and personal computers, but security systems, dishwashers, washing machines with microprocessors, security systems are sensitive to surges caused by



lightning.

PROTECTION OF COMMUNICATION.

For administration work, data processing has become indispensable. PCs, servers and networks are standard equipment, and a breakdown is unacceptable. Moreover, there are building automation

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systems interconnected via bus systems. Everything has to work without interference.

INCREASING OPERATIONAL SAFETY

Industrial automation is standard in most companies. A breakdown of the production can be financially devastating, and insurances against operational breakdowns are often nonexistent.

WHAT ARE SURGES AND HOW DO THEY COME INTO EXISTENCE?

Surges are short-time voltage impulses – so called transients – which only occur for a few seconds, with peak voltages of several 10,000 Volt. Surges arising due to thunderstorms are caused by direct or near lightning strikes or

strikes from a distance (Fig.1). Direct or near lightning strikes are strikes into the lightning protection system of a structure, into its immediate surroundings or into the constructive systems entering the structure (e.g. low voltage power supply, telecommunication and control lines). Due to the amplitudes and energy loads, the arising impulse currents and impulse voltage represent a special risk for a system. During a near or direct lightning strike, the surges (fig 1: Case 1a) are caused by a voltage drop at the impulse earthing resistance and the resulting potential increase of the structure towards the distant surroundings. This is the maximum load on electrical installations in structures.

The characteristic parameters of flowing impulse currents can be described with the impulse-current wave form 10/350 μ s (Fig. 2) and defined in international standards as test currents

for components and devices for protection against direct lightning strikes.

Additionally to the voltage drop at the impulse earthing resistance, surges are caused in the electrical structure and the connected systems and equipment due to induction effect of the electromagnetic lightning field (Fig. 1: Case 1b). The power of these induced surges and the resulting impulse currents is considerably lower than the power of a direct lightning impulse current and is, therefore, only described with the impulse current wave form 8/20 μ s (Fig. 2). Components and equipment which do not have to carry currents out of direct lightning strikes are therefore, tested with impulse currents of 8/20 μ s.

PROTECTION PHILOSOPHY

Distant strikes are lightning strikes

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from a distance to the object to be protected, lightning strikes into the medium voltage overhead line network or into its immediate surroundings, or lightning discharges from cloud to cloud (Fig. 1: Case 2a, 2b and 2c).

For ensuring a continuous availability of complex electrical and IT-systems, even in the case of a direct lightning effect, further measures for the surge protection of electrical and electronic installations are necessary, based on a building lightning protection system. Taking all causes of surges into consideration is very important. For this purpose, the Lightning Protection Zone Concept is defined.

SAFETY ACCORDING TO SPECIFICATION THE "LIGHTNING PROTECTION ZONE CONCEPT"

Failures of technical systems and installations are very unpleasant for operators. These require faultless operation from equipment both under "normal" conditions and in the case of thunderstorms. A comprehensive protection concept would help to compensate it. Protection against surges is necessary for

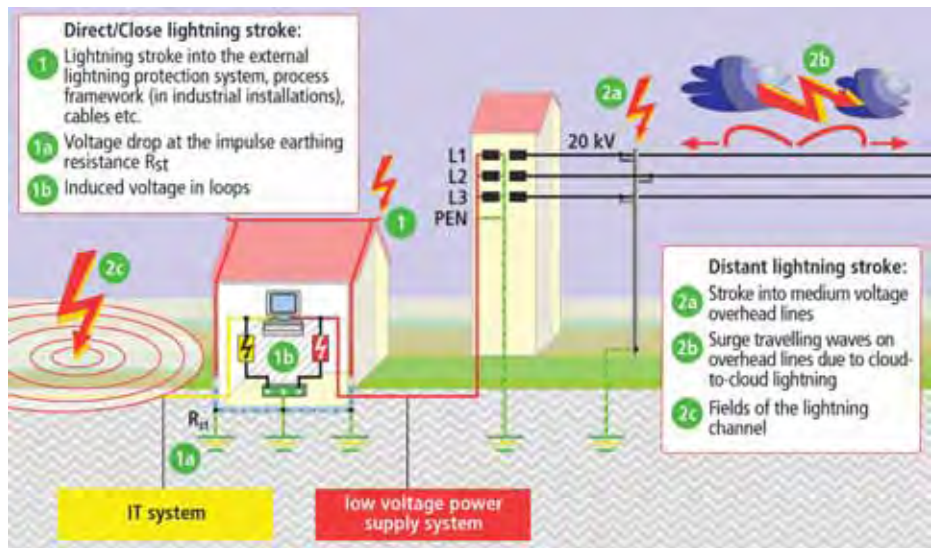


Fig. 1 Causes of Surges in Lightning discharges

companies on the web. Every company has more than enough sensitive targets for these destructive transients: power supply, EDP system, IT systems, control system of production facilities via field bus, telephone system, the regulation of the air conditioning and heating, lighting control, etc.

For this purpose, lightning current and surge arresters are used. Lightning current arresters are responsible for the

conduction of high energies without damage. The surge arresters protect the terminal equipment. Lightning current arresters have to be installed as close as possible to the service entrance of the electrical system, and surge arresters as close as possible to the equipment to be protected. That is why power bars with a surge protector unit are not sufficient to handle the power and high energy of lightning currents.

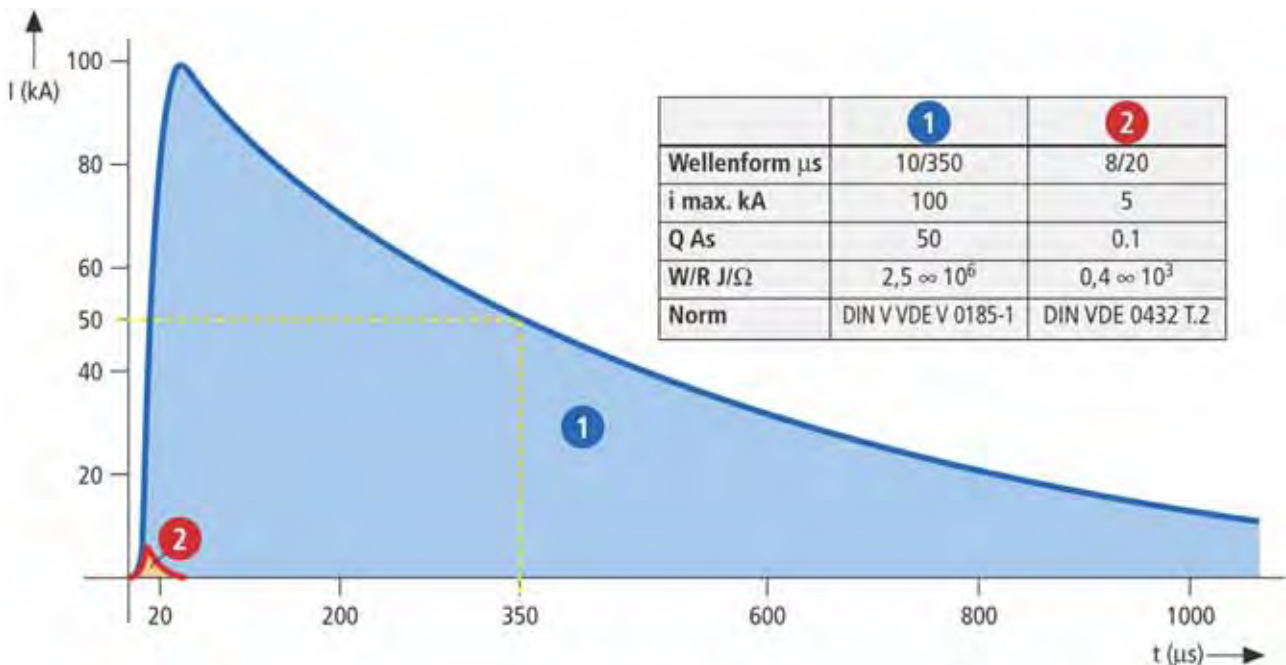


Fig. 2 Test impulses for Lightning arresters (1) and Surge arresters (2)