

The Need for Coordinated Protection

Critical Factors

Critical factors need to be considered when determining the need for facility protection. Many factors can be determined by answering the following questions:

- What is the risk to personnel?
- What is the risk of equipment damage?
- What are the consequences of equipment failure?
- Is the equipment associated with an essential service?
- How will equipment failure affect overall facility operation and revenue generation?
- What are the legal implications of providing inadequate protection?

The statistical nature of lightning and the broad spectrum of energy delivered by a lightning flash, the problems created by various power generation and distribution systems, and the continued trend to more sensitive and specialized electronics, requires careful selection of available technologies if adequate protection is to be provided.

What are the costs of inadequate protection?

The costs that can result from inadequate protection are many and varied. The type of equipment within a facility will have a direct impact on the damage that can occur. Robust equipment, such as lighting and air-conditioning systems, are often able to withstand impulses as high as 1500 volts and are not as sensitive to the rapid rate-of-rise exhibited by the pre-clamped surge waveform as are electronics. These systems are often not critical to the continuing operation of the site and therefore usually do not require the premium level of protection that is essential for more sensitive equipment.

However, significant damage can occur, even to the more robust systems, as a result of lightning induced surges resulting within a radius of several kilometers, or from switching induced surges.

Costs can range from degradation of electrical or electronic systems to data loss, equipment destruction or injury to personnel. Some of these costs can appear relatively minor but the loss of an essential service or revenues associated with a facility or plant shut down can be enormous.

According to the Insurance Information Institute, NY, (NY Press Release 11 August 1989): Lightning and over-voltage transients cause damage to property, electrical, electronic and communications equipment estimated to be more than US\$1.2 billion dollars per year in the US alone. This represents approximately 5% of all insurance claims in the US. Costs in more lightning prone regions of the world are even greater.

According to Holle, et al., Journal of Applied Met, Vol 35, No.8, August 1996: Insurance claims to lightning and over-voltage damage amount to US\$332 million annually in the US. On average this represents one claim for every 57 lightning strikes in the US.

Sources of Transients and Surges

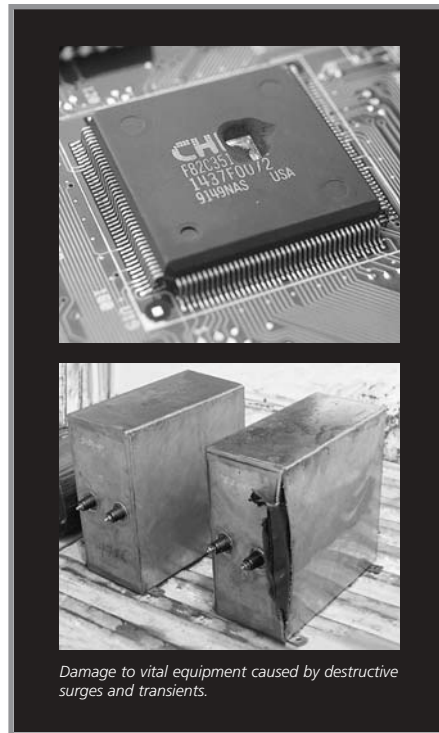
Although lightning is the most spectacular form of externally generated surges, it is only one source of over-voltage. Other sources include the switching of power circuits, the operation of electrical equipment by neighboring industries, the operation of power factor correction devices, and the switching and clearing of faults on transmission lines. It is important to note that lightning does not

need to directly strike a power line for such damage to occur; a strike several hundred meters away can induce large damaging transients, even to underground cables.

It is estimated that 70 to 85% of all transients are generated internally within one's own facility by the switching of electrical loads such as lights, heating systems, motors and the operation of office equipment.

Modern industry is highly reliant on electronic equipment and automation to increase productivity and safety. The economic benefits of such devices are well accepted. Computers are commonplace and microprocessor-based controllers are used in most manufacturing facilities. Microprocessors can also be found embedded in many industrial machines, security & fire alarms, time clocks and inventory tracking tools. Given the wide range of transient sources and the potential cost of disruption, the initial installed cost of surge protection can readily be justified for any facility.

As a guide, the cost of protection should be approximately 10% of the cost of the facility's economic risk.

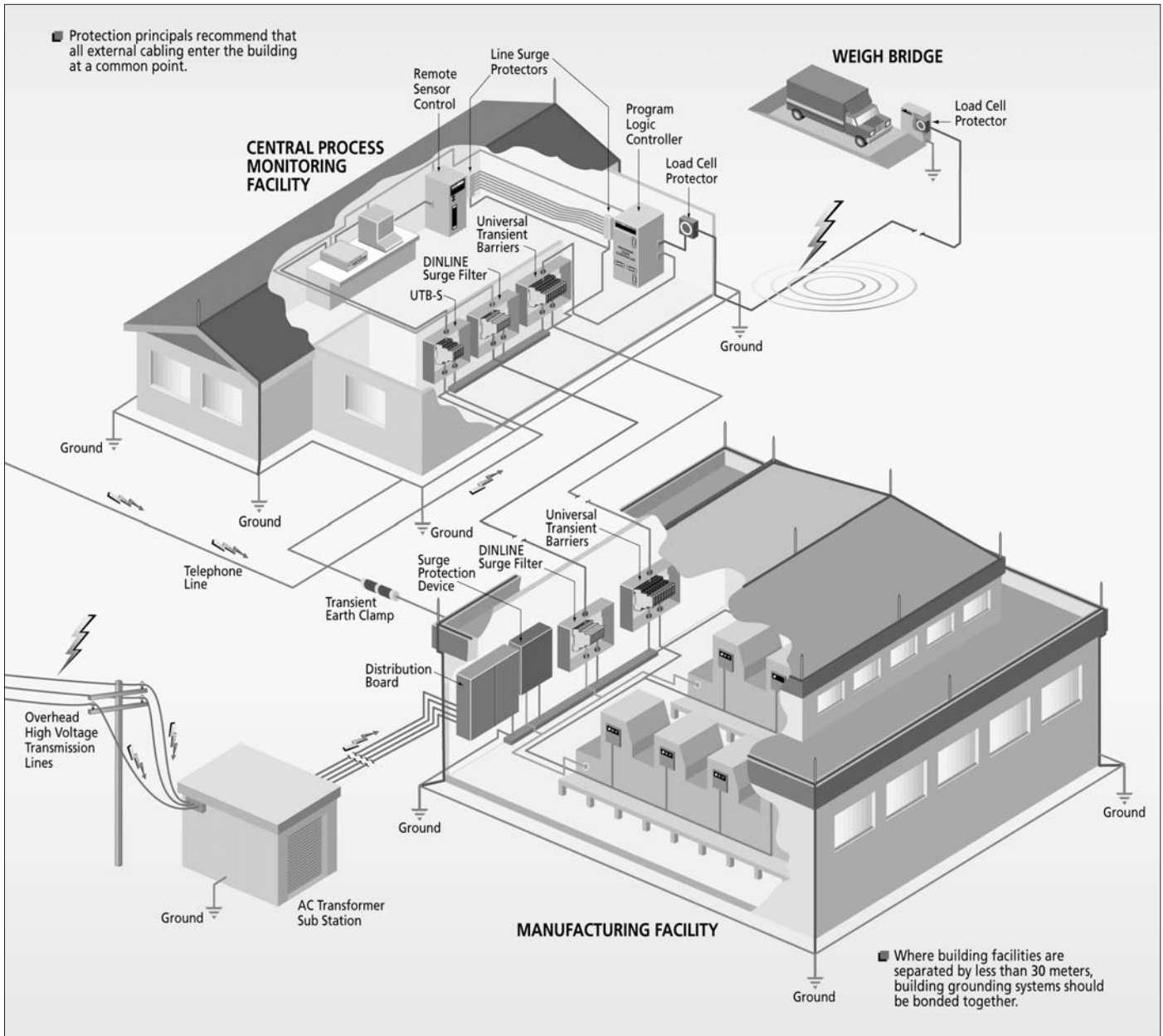


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Reliable protection of structures, industrial and commercial operations and personnel, demands a systematic and comprehensive approach to minimizing the threats caused by transient over-voltages. Grounding, bonding, lightning protection and surge protection all need to be considered for comprehensive facility electrical protection. Each of these are interdependent disciplines that need a holistic design approach to ensure the facility is not left with a vulnerable "blind spot". The investment in surge protection can be wasted if "blind spots" exist. For example, installing a surge protection device on the power supply to a programmable logic controller is of little value if the I/O lines are not also protected. In addition, an air terminal on the facility may capture the lightning energy but without a dependable ground

system, this energy cannot be safely dissipated. Equally, even the most expensive Surge Protection Devices (SPDs) are poor performers if a low impedance equipotential ground is not provided. These interdependent disciplines are best applied when looking at a total facility rather than at an individual piece of equipment or portion of the facility.

It is for these reasons that the ERICO® Six Point Plan was developed. The plan prompts the consideration of a coordinated approach to lightning protection, surge and transient protection and grounding, an approach that embraces all aspects of potential damage, from the more obvious direct strike to the more subtle mechanisms of differential earth potential rises and voltage induction at service entry points.



The Six Point Plan applied to a manufacturing facility. Surge and transient protection principles applied to a total facility rather than individual pieces of equipment.

