

TRANSIENT VOLTAGE

Whether it's a factory, a bank, a hospital, the local supermarket or simply your home, the one problem common to all of these locations is "Electrical Pollution". Sudden short duration, high amplitude disturbances in the normal voltage levels across power lines are called voltage transients. Transient Voltage is a term often used to describe these extremely short-lived bursts of high voltage electricity found in almost all electrical systems. Although lightning causes some of these transients, most are caused by the switching on and off of internal and external loads and occur regularly on any power system. On residential 120 VAC lines, these voltage transients can peak momentarily at many thousands of volts when caused by lightning and at several thousand volts when caused by switching. With the age of electronics upon us, "transient voltage is a problem we must learn to live with or take action to eliminate".

No matter how much care is taken by the power companies to supply you with clean electrical power, the fact remains that simple variables, such as load switching and fluorescent lighting can and will cause transient voltage problems. These high voltage power surges are almost always present when power is restored to a dead line and immediately following a voltage drop.

Transient Voltage is transmitted to all parts of the building via your electrical wiring. Transients (surges or spikes) can be generated any time you have changes in current flow demand or a load shift. The random cycling of motors, energizing or de-energizing of transformers and motor circuits, and power source faults create havoc with your electrical system. Even such routine things as turning on and off a light switch can cause vast amounts of voltage transients.

The Effects of Transients on Lighting

Fluorescent lights are designed to operate at a normal line voltage and within rather narrow temperature ranges.

Voltage between the electrodes, ionize the gas within the light. Transient surges cause the excess kinetic energy developed to displace the material of the electrodes. This is "sputtering", and can eventually reduce the amount of light produced by the fluorescent tube and cause an increase in the amount of power required to ionize the gas.

Surges decrease the life of fluorescent lighting by wearing out the bulbs. Worn bulbs are the main cause of burned out ballasts.

The Effects of Transients on Induction Motors

In industrial, and commercial facilities as well as residential locations, the switching on and off of motors used in machines, tools, air conditioners, refrigeration and air compressors, and other equipment with heavy starting loads is a major source of high voltage power line surges commonly referred to as transients. Electrical systems in office buildings are subject to the bombardment of transients from numerous sources including elevators, printing equipment, copy machines, computers, typewriters and a lot of other electrical devices.

All motors are affected by power surges. Approximately 20%-25% of the power surges come from the Power Company and various other outside influences such as lightning. 75%-80% of surges are generated internally. Every time a switch is turned off or on, or a motor starts, stops, loads, or

unloads, a surge is generated. Surges, even though short in duration, result in motors overheating and/or running hotter than they are designed for.

Ever present in power systems, transient voltage can also cause vibration, noise, excessive wear, and heating of motors as well as pining and corrosion of motor contacts. Contact arcing can cause a motor to require more current, shortening the motor's life by increased heat from the pining and carbon buildup on contacts and brushes. This leads to inefficient operation of equipment, accelerated wear, excessive down time, increased maintenance expense, and in some cases, destruction of costly equipment.

Motors being made of metal are excellent conductors of heat (surges are energy, energy is heat), and induction type motors have metal axles within a metal bearing. It is really not complicated to understand that when a metal axle and bearing are overheated the tolerances are reduced, thereby creating extra friction and drag. When the motor senses the problem by slowing down, it then calls for an additional power draw so that it can continue to run at the speed it was designed for.

By eliminating or minimizing the problem with transient voltage, contact arcing is minimized, the natural rubbing action that is built into most contacts allows them to clean away the carbon build-up. The motor will run cooler and quieter, and energy previously dispersed, as heat is no longer wasted.

The Effects of Transients on Computers and Semi-Conductors

Most semi-conductor devices are intolerant of voltage transients in excess of their voltage ratings. Even such a short-lived transient as a few microseconds can cause the semiconductor to fail catastrophically or may degrade it so as to shorten its useful life.

The effects of voltage transients can appear almost immediately or can have a damaging cumulative effect. Transients can disrupt, damage or completely destroy electronic equipment, instrumentation, computers, telecommunications equipment and devices as well as the solid circuitry found in most types of appliances.

Technological advances have brought computers and other microprocessor controlled equipment into all phases of our lives. Transients can create havoc in this equipment that shows up in a variety of ways. It is estimated that 70 to 90 percent of the malfunctions occurring in microprocessor controlled equipment are a direct result of transient impulses. For example, transients can be interpreted as data impulses, which can result in random memory alteration or failure. And because of their extreme sensitivity, memory chips and microprocessors can experience circuit melting corrosion and arcing resulting in reduced component life. In disc drives, pitting and metal transfer between switch contacts can occur. Transients can also render entire data blocks and discs unusable.

There are today an untold number of machines and devices that are controlled by micro-processors and they are very susceptible and vulnerable to power surges.

The surges will either wipe out memory, which can be catastrophic while requiring a lot of reprogramming, or at least require new circuit boards that are also very costly.

"Virtually every computer installation should be protected from dirty unstable AC power which is very common. If you're not protected, the results can be disastrous."