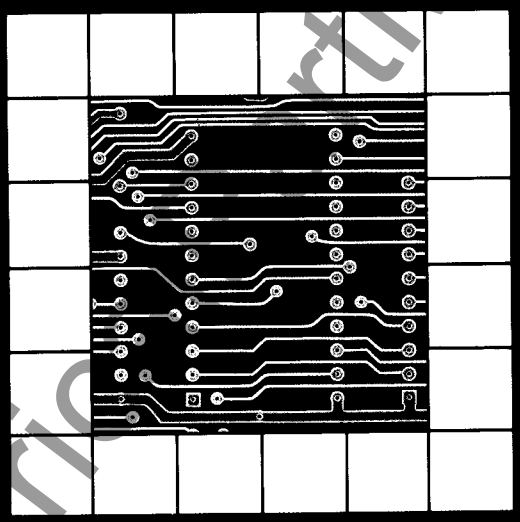
GE Capacitor & Power Protection



Tranquell® High-Energy Surge Protectors.

Why your business may need surge protection for sensitive electronic and electrical equipment.

Picture this: It's eleven o'clock on a busy morning at an electronic design office. A team of consultants is working feverishly—has been working since six that morning—to put the finishing touches on a software program promised for delivery that afternoon. This is a big job—an extremely important test case for this small, innovative engineering design firm. If this job goes right, if it gets done on time, if the client is pleased, there will be bigger and more challenging software package designs to come.

The work is going well. People are tired but excited as they see the work coming together. Then, four short hours before the presentation, things stop going well.

The team anticipated problems getting this design finalized. But no one counted on the weather being a factor. No one counted on lightning hitting a nearby transformer, sending a surge through the firm's computer system, and totally eliminating the last few hours of work.

Fifteen years ago, the firm in this scenario might have been unusual, but no more. In the past decade or so, businesses have come to rely more and more on sophisticated, highly sensitive electronic equipment. Factories depend on process controls for manufacturing and quality control. Television stations rely on computers for news and weather data. Offices function more efficiently with extensive personal computer networks. And scores of other businesses, from data processing to telecommunications to medical technologies to utilities, are inextricably wedded to the use of solid state equipment in their daily operations.

As all these businesses and industries become more and more dependent on this sensitive equipment, whether for data storage, communications, operations, or hundreds of other applications, the consequences of equipment damage or malfunction, service interruption, and data loss are greater than ever.

Unfortunately, the story of our young engineering design firm is not exaggerated. Power surges do occur—with unfortunate regularity. And, unless you protect your equipment—*protect your business*—against surges, damaged or malfunctioning equipment could seriously hinder your operations.

What causes power surges?

Surges on power systems—also known as transients—result from energy being released into the system. In low-voltage AC power circuits, surges have two basic origins: lightning or switching events.

When lightning strikes on or near a primary circuit, it produces a transient voltage which is transmitted through a transformer to your secondary circuit. Or, lightning may strike on or near the secondary circuit, which results in an even higher energy surge to your equipment.

The second cause of power surges—a switching event—can be generated by either external or internal conditions. Externally generated switching events may be caused by breaker operation, capacitor bank switching, or a fault somewhere on the system. An internally generated switching surge may result from the shutdown of equipment such as compressors, air conditioning, or machine tools, or from the operation of devices that limit current flow, such as breakers or fuses.

Wherever it strikes, however, and whatever the source of the surge, the result is the same: if unprotected against transient overvoltages, your equipment may be disabled or even damaged, you may lose important stored data, and your business will be at least temporarily thrown into a period of downtime.

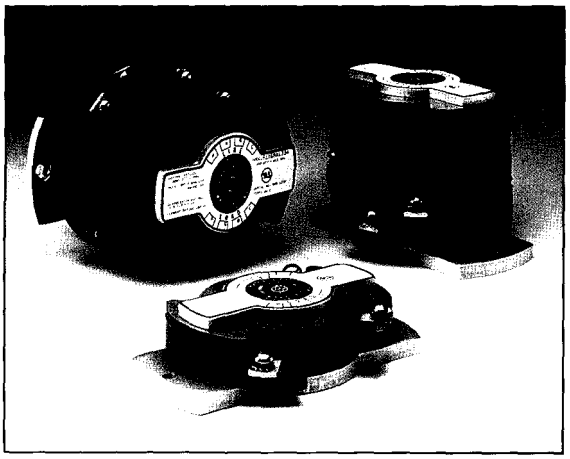
How do you protect your equipment from power surges?

Power surges are a fact of life. Lightning storms are destined to occur, and equipment failure is bound to happen. There is no way to prevent power surges from occurring—but there is a way to protect your business from the havoc a surge can wreak on your valuable equipment.

GE's Tranquell® high-energy surge protectors will give you that protection.

A surge protector is exactly what its name implies: a device that protects your electronic and electrical equipment from transient overvoltages.

Basically, surge protectors *suppress* surges that occur, whatever their origin. The protector is an energy-handling device: it can absorb and dissipate thousands of joules of energy. Here's how surge protectors work: Imagine an electrical storm, with a lightning strike on a power line. The protector responds to the transient overvoltage—or surge—produced by the lightning by changing from its normal high resistance to low resistance and conducting surge current. This current, and the resistance of the protector, results in a discharge or residual voltage across the protector. This same voltage is "seen" by the protected equipment and defines the protective capability of the surge protector. The ability of a surge protector to handle a given amount of energy reflects its ability to "survive" and to continue to protect your equipment. This capacity to continue to protect your equipment surge after surge is extremely important in choosing a surge protector.



GE's surge protectors help protect your sensitive equipment against surges by conducting surge current and limiting the voltage. Their tremendous energy-handling capability provides a long life when properly applied.

No protector can survive a direct lightning strike. A strike close to the protector which subjects the device to surge current in excess of its capability or exceeds the energy rating will also fail the protector. The failure mode for the Tranquell® high-energy surge protector is shorted.

How do I evaluate a surge protector?

One way of evaluating the effectiveness of any surge protector is by the reliability of its field record. If you study the test data (included in this brochure), you'll discover that GE's high-energy , low-voltage protectors are without peer. Our Zenox™ zinc oxide technology has made possible cost-effective, maintenance-free devices that are able to absorb thousands of joules of energy.

Consider these GE advantages:

Long-term stability. GE's surge protectors are designed to withstand normal system voltage over the life of the protector. Properly applied units will not need to be replaced.

Low discharge voltage. Provides better protection for equipment and systems against lightning-generated transients.

Switching surge protection. Low switching surge discharge voltages give you maximum protection against high-energy switching surges, whether internally or externally generated.

High surge current capability. Our units can conduct high current surges in high exposure applications and continue to provide protection.

High energy-handling capability. GE surge protectors can survive in high-current, long-duration surge environments and protect lower voltage devices and sensitive filters.

Stability of protective characteristics. Because discharge voltages do not increase with impulses applied over a period of time, GE units continue to provide the same level of protection after many years in service and many surge applications.

Temporary overvoltage capability. Design characteristics allow the units to survive periodic system low-frequency overvoltages without sacrificing protection.

Series connection. The ability to connect the units in the series configuration provides optimum protection. This connection keeps lead length inductive voltage to a minimum and provides low protective levels for each rating.

UL Recognition. GE's Tranquell® high-energy surge protectors are UL recognized and listed and are available in voltages from 120 V to 575 V, in a variety of configurations.

How do I protect my system or equipment at installation or solve existing surge generated problems?

Surge protection is a complicated issue, but there are some procedures you can follow.

- ☐ Ensure your facility's electric supply system is properly installed and connected in accordance with all applicable national and local codes and safety procedures. All equipment and systems should be installed in accordance with manufacturer's instructions.
- ☐ Utilize your local utility, your engineering department, G.E. application or service engineering, or a competent consulting engineering firm for technical guidance or troubleshooting.
- ☐ Understand your system and the capabilities and limitations of surge protectors and other power conditioning equipment.
- ☐ Surge protection equipment should be installed by competent, trained personnel with proper safety procedures. Improper installation can defeat the protective function of a surge protector.
- ☐ Select the proper Tranquell® unit for your system voltage, configuration, and the anticipated surge environment in terms of energy capability.
- ☐ Install a Tranquell® high-energy surge protector in accordance with the applicable drawings, connection diagrams, and instructions. Use instruction book (GEH-5345A) or the latest revision for proper installation, application, and procedures.

How do I find out more about GE's Tranquell® high-energy surge protectors?

For more information on how to use GE Tranquell® surge protectors in your business, contact your nearest GE sales office, a GE franchised distributor, or call the GE Business Information Center at 518-438-6500.

GE Capacitor & Power Protection

Capacitor & Power Protection Operation
General Electric Company
381 Upper Broadway
Fort Edward, NY 12828

Form Number GED 7084

681-3 10M 9-89

GE's Tranquell® surge protectors are tested and proven.

Impulse protective characteristics.

Discharge voltage tests.

Surge protector samples were subjected to 8 x 20 microsecond current waves ranging in crest values from 10 amperes to 50,000 amperes. These tests establish the volt-amp curves used in evaluating the protective level of the devices.

Protective Characteristics

The volt-ampere curves based on the tested values are available. The tests were made with the series connection. Specific curves are available for each individual Tranquell® device.

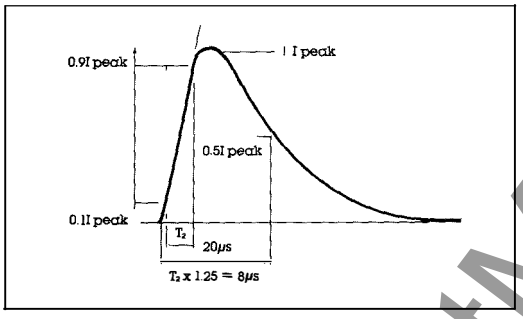


Figure 1. Discharge current waveform.

High current short duration tests.

Sample units were tested for high current short duration capability. This demonstrates single pulse surge current capability.

All three phases of each test unit were measured for crest voltage at 5 milliamps 60 Hz crest before impulsing for comparison with after-test values. Each phase then received 2 to 5 impulse shots of 50,000 amps of 8 x 20 microsecond current 1 minute apart while energized at maximum continuous operating voltage; 60 Hz voltage and leakage current were monitored during each impulse. All phases of all samples had decreasing leakage current after the final impulse indicating thermal recovery. After cooling, voltage measurements were again taken at 5 milliamps 60 Hz. The maximum increase in voltage was 2.6%. These test results indicate a single pulse transient current capability greater than 50,000 amps (8 x 20 microsecond) per ANSI C62.33 4.5.

Switching surge protective characteristics.

The 36 x 90 microsecond characteristic used to define switching surge protective characteristics (allow evaluation of protection provided against switching-generated transients) for surge arresters is not specifically called for by ANSI standard 62.33 "Test Specifications for Varistor Surge Protective Devices," but switching surges do occur in the low-voltage environment. Switching surge tests were made on a Tranquell® high-energy, low-voltage unit and values are available.

Energy-handling capability.

Energy-handling tests (quantify the ability of the protectors to survive high-energy surge events) have been performed on the Zenox™ disks to verify the published capability of the Tranquell® surge protectors. The ability of the disks to absorb energy without cracking from thermo-mechanical stress was determined by discharge currents of half sinusoidal wave shape and crest values of approximately 650 amps. After such an absorption of energy, approximately one minute is required for temperatures within the disk to equalize before the disk is capable of absorbing a similar level of energy without risk of damage.

Effect of repetitive high-energy pulsing on high-energy, low-voltage protector Zenox™ disks.

Tests were conducted to evaluate possible degradation effects which repetitive discharges might have on high-energy, low-voltage protectors. This was an indication of the protectors' ability to maintain their characteristics even in severe surge environments. These tests consisted of applying, at approximately 1 minute intervals, as many as 15,000 discharges at full-rated energy to the Zenox™ varistor disks used in these units. The discharge currents ranged from 300 to 1600 amperes crest. The evaluation consisted of monitoring the 60 Hz watts loss at operating voltage and the discharge voltage (protective level) for 100 A and 10 kA impulse discharges.

The watts loss remained essentially unchanged or even decreased somewhat while the discharge voltages increased slightly over the first few thousand discharges, after which essentially no further increase was obtained. In the worst case, the discharge voltage increased about 9% at 100 A and only about 4% at 10 kA. Since the operating watts loss did not change significantly and the protective levels increased less than 10%, it is concluded that repetitive discharges even for a very large number of shots will have no detrimental effects on these disks. It must be recognized that adequate cooling and/or sufficient time between discharges must be provided so that overheating of the disks does not occur.

Because Tranquell® protectors have Zenox™ valve elements, the units can survive high current events and continue to protect your equipment.

Applications for Tranquell® high-energy surge protectors.

Today, as more and more businesses use sensitive electronic and electrical equipment, the need for surge protection is shared by a wide range of industries.

Data Processing

Original equipment manufacturers

- ☐ Incorporate protection in equipment
- ☐ Provide surge protectors for large or critical installations
- ☐ Offer as peripheral equipment line
- ☐ Provide as a field service item for problem locations
- ☐ Front end protection for UPS equipment

Mainframe installations

- ☐ Protectors purchased and installed by users
- ☐ Protectors installed at construction stage for mainframe facilities
- ☐ Front end protection for UPS equipment

Multiple PC installations and networks

- ☐ Service entrance protectors for offices using computers
- ☐ Protection at a main branch panel dedicated to a network of computers
- ☐ Front end protection for UPS equipment

Communications

Telecommunications

- ☐ Microwave centers
- ☐ Satellite centers
- ☐ Central switching buildings
- ☐ Front end protection for UPS equipment

Broadcast

- ☐ Newsroom computers
- ☐ Weather computers
- ☐ Transmitter control equipment
- ☐ Studio control equipment

Industrial Electronics

Drive Systems

- ☐ Earth-moving equipment
- ☐ Manufacturing processes
- ☐ Motor drives

Manufacturing

- ☐ Process controls
- ☐ Test and measuring equipment

Transportation

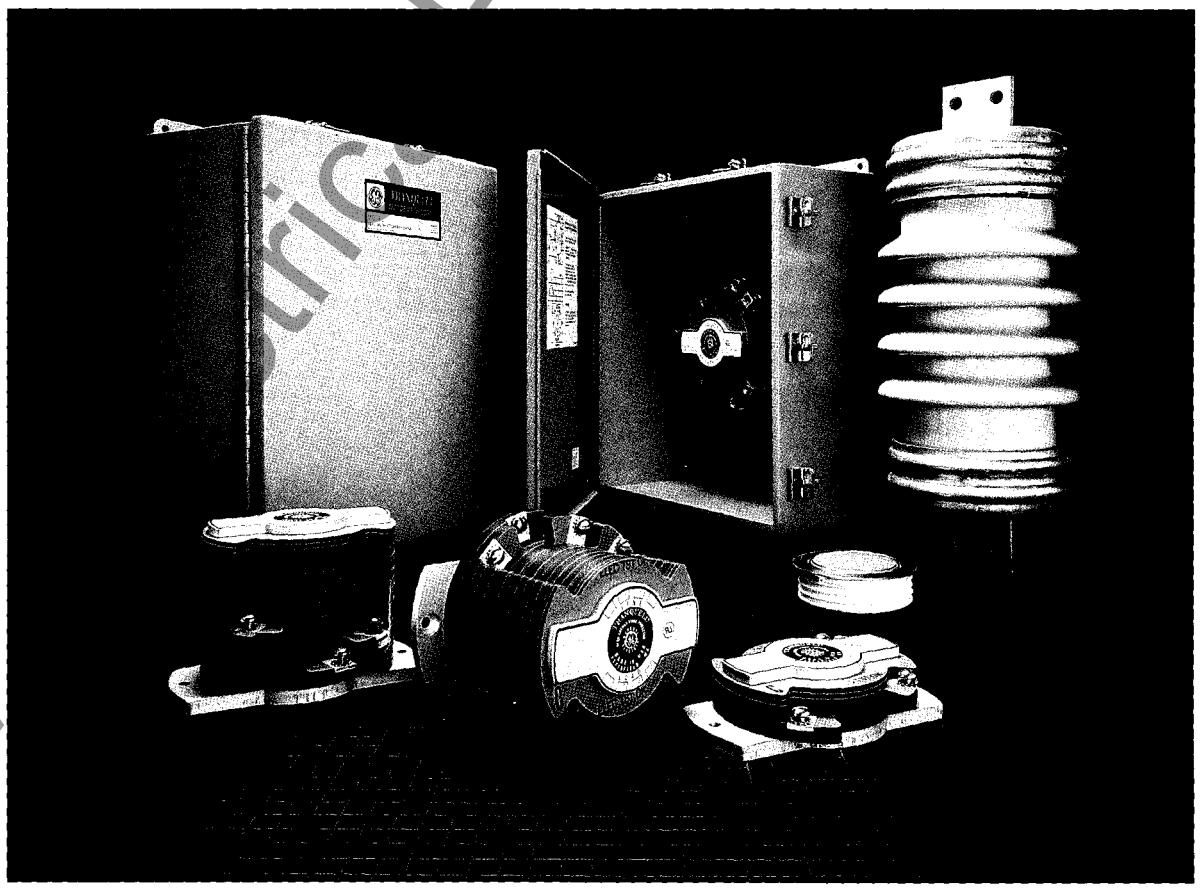
- ☐ Protection of motors on electrified railways

Medical Electronics

- ☐ Front-end transient protection for UPS or filter equipment for CAT scan, x-ray, and magnetic resonance equipment
- ☐ Transient protection at power supply for critical equipment

Utilities

- ☐ Transient protection for premium service accounts
- ☐ Protection on service for computer and solid state control loads
- ☐ Field service use for installation at chronic surge problem locations



Tranquell® surge protectors are available in a full selection of configurations–as a basic unit or with enclosure–for the common application voltages: 120, 208, 240, 480, and 575. Units are available in two energy levels for the standard ratings. For very high energy applications, disks can be matched for parallel operation and housed in porcelain.