

SOME ELECTRICAL ENGINEERING ASPECTS OF DAMAGE

21st-Century Impact on Electrical Apparatuses in Buildings and Manufacturing Applications

Loading is More Sophisticated — Going Green — Fewer Spares

Electrical apparatuses (generators, switchgear, transformers, motors, etc.) are used to generate, direct, transform, and utilize electricity. Our economy has changed a lot since much of the electrical apparatuses in this country were installed in the second half of the 20th century, and this has ramifications on dealing with damage today. Some Damage Engineering insights:

CAUSE—A lot more is expected from grounding systems today; many were designed for a simpler era. At one time, resistive loading (incandescent lighting) and motor loading shaped the electrical system and its design and protection.

The loading on electrical systems is now more sophisticated. Information technology and increased sophistication of machinery and equipment have changed characteristics of electrical loads.

- Loading 24/7 is far more prevalent, as are variable frequency drives which are non-linear.
- Incandescent lighting is a linear load. Fluorescent and high-intensity lighting are non-linear loads.
- Power electronics (uninterruptible power supplies, rectifiers (AC to DC), etc.) with their high-frequency switching can increase harmonic currents.

Now, as a result of this change in loading, much of the *commercial* and *manufacturing* load is non-linear with high harmonic content.

The electrical energy associated with high energy faults can cause severe damage to electrical apparatus and, if not isolated quickly, can lead to fires.

The most common result of insulation breakdown is ground faults. The present trend of ever-increasing sophistication and amount of the loading can increase the rate of aging and breakdown due to stressed insulation and grounding system failures: grounding systems often deteriorate due to corrosion over time, and are often not tested, or upgraded, after initial installation.

COST—The current high price of a barrel of crude oil is accelerating national progress in “going green.”

Going green can have a variety of impacts on cost.

The economy is ever changing. It has changed a lot over the 38 years of investigations conducted by Douglas G. Peterson & Associates, Inc., Multidiscipline Damage Engineers™. We continuously stay at the cutting edge, investigating damage wherever it occurs. Call us the next time you need engineering assistance on damage.

- Increased efficiencies are often gained by adding sophistication to the electrical apparatus—often more controls.
- Alternative sources of energy are increasing the types and dollar value of electrical apparatuses one finds at a damage site, such as:
 - Photovoltaic equipment and other renewable generation
 - Rectifiers (which convert DC or battery-type power to AC or household-type power)
 - Controls to allow power distribution alternate power sources (photovoltaic, wind, etc.) to run in parallel with the grid
 - On-site generators
- Green technology can change the balance between repair of older equipment and replacement. Current price incentives can make it less expensive to replace rather than repair and upgrade when the desired outcome is to achieve green design goals.

DOWNTIME—There can be long lead times in obtaining electrical apparatuses when one needs to replace them: there are typically *fewer spares*.

The 21st-century trend of minimizing spares is building a rental market, making rental equipment more available as a temporary solution for the long replacement lead times of electrical apparatuses.

The minimal spares inventories at *manufacturing* and *energy plants*, *infrastructure sites*, and *commercial buildings*, coupled with the market for used equipment created by the globalization of the industrial economy, is increasing the salvage value of many electrical apparatuses.