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Testing Times

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Meeting Harmonics Specifications:

What's IEEE Standard 519-1992?

IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

In 1986, the Industrial Applications Society of the IEEE wrote a standard for electronic equipment such as adjustable speed drives. Electronic equipment has the ability to turn on (and sometimes off) the flow of electricity during a cycle, thus regulating the energy. A common example is a lamp dimmer, but electronics are found everywhere today doing a wide variety of jobs. The ability to make the current flow different from the rise and fall of the voltage makes the relationship nonlinear, and power electronics are called nonlinear loads. The shape of the current drawn by nonlinear loads often does not look like the sine wave voltage, but rather a messy batch of sharp-edged boxes or smooth-edged bumps. Harmonic currents cause extraordinary heating in magnetic equipment designed for normal AC power. Because transformers and motors

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are designed to be most efficient on sine waves, the sharp corners and abrupt changes result in excess heat and wasted energy. Increased losses are a concern, but poor performance, failure, and misoperation of other equipment like capacitors and fuses result in lost productivity.

Does Equipment from Major Manufacturers Meet IEEE Standard 519?

Today, IEEE Standard 519 isn't an equipment standard; it's a recommended engineering practice for equipment installation. So, no, modern equipment doesn't necessarily meet standard 519, nor does it necessarily violate the standard. The standard simply sets some limits on voltage distortion so that all equipment, both traditional and electronic, will perform as expected. Current limits based on standard transformers are shown in order to help meet the voltage limits, but these are not the limits on individual equipment.

Three Requirements

To check an installation or proposed installation against the standard, three things must be known about the installation.

1. The point of common coupling, or PCC. This is the electrical point where other equipment may be connected. Usually, it's the point where the utility might connect a different customer, but on a campus it might be where another building service might connect. It's the place where the waveshape should be trouble-free, as provided to the "user."
2. The short circuit current at the PCC. Rather than the "worst case" current that the coordination studies require, this would be the "normal case" available short circuit current.
3. The demand current at the PCC. This is the maximum electrical demand that the total

(continued on page 2)

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load makes on the system. These answers require some thought and maybe research. In a new installation, they are usually guesses.

Most Common Misuse

The most common misapplication of IEEE Standard 519 is trying to apply the current limits to an individual piece of equipment. Often a requisition is written to require that an adjustable speed drive (or other power electronics) meets IEEE Standard 519. Actually, it's the installation that the standard addresses, and not every piece of power electronics can be installed everywhere without some thought. Equipment that happens to not exceed the harmonic currents in IEEE Standard 519 will likely not cause problems, but that may be too restrictive to be practical. The fact is that waveform distortion can cause problems. Many think of harmonics as "pollution," and there are parallels. A little does no harm, but a lot is troublesome. The farther away one gets from the source, the less there is. Small sources combine to make a larger problem. And so forth.

Testing For Problems

Most installations don't actually cause problems. Commercial installations with computers have caused the National Electrical Code to be revised because of harmonics. The traditional smaller neutral wire in three-phase distribution turns out to be inadequate for large numbers of single-phase computer power supplies. The neutral conductor may have more current than any of the associated phase conductors.

In a facility, there are quick tests to see if harmonics might be a problem. At the incoming power bus, a quick test of voltage harmonics should show less than five percent total harmonic distortion. On a 'scope, two percent is barely discernable, and five percent looks like a mildly distorted wave. Elsewhere in the facility, eight percent total voltage distortion is most likely no problem. On a 'scope, that looks like noticeable distortion. The next version of IEEE Standard 519 will likely include that recommendation for busses at 1000 volts or less. An easy test at an outlet is to measure the frequency between neutral and ground. A modern voltmeter, set to frequency and connected between neutral (white wire, wide slot) and ground (green wire, round slot) should read 60 Hertz in North America. A reading of 180 Hertz indicates computer-style harmonics and signals the need for further investigation. ❖

Note from the Editor

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