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Technical Bulletin

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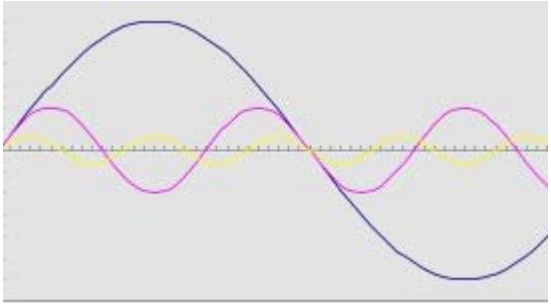
Harmonics in Electric Power Systems

How to decrease Electrical Power Consumption

READING ELECTRIC, a leading supplier of electro-mechanical equipment, services, and problem solver for Industrial and Commercial customers for over 50 years provides technical information to the Region's Residential, Commercial and Industrial Community. This Bulletin provides information on the critical issue of harmonics in electrical power systems.

Harmonics are currents (or voltages) at integral multiples of 60 Hz. The currents of a balanced three-phase system are equal, canceling each other when they return in the neutral. When odd order harmonics exist; the three phase return currents remain in 'phase' with one another and are additive. The result can be the harmonic phase currents and all odd multiples combine for a total possible neutral current of up to 1.73 times the phase current. These out-of-balance harmonics in your electric power system can result in a potential fire and safety hazard, poor equipment performance, **increased electrical energy consumption**, and premature failure.



Some types of equipment have non-linear load drawing characteristics and therefore have a tendency to input harmonics into a power system. Some examples of this type of equipment are: power supplies, transformers near saturation, variable speed drives, welding equipment, UPS equipment, florescent lighting systems and electrical test equipment.

IF HARMONIC PROBLEMS EXIST, you may be experiencing one or more of the following symptoms:

1. Overheated neutral conductors on three-phase four wire circuits.
2. Transformer humming.
3. Frequently blown fuses on circuits of variable drives, rectifiers, UPS, power factor capacitor banks, diode/thyristor-controlled loads.
4. Poor picture quality on monitors, PCs.
5. Overheating motors.
6. Higher than actual meter reading errors on electric current and watt meters.

To resolve or minimize the effects of harmonic loads, it is best to have trained personnel examine your equipment and make the necessary revisions. Possible enhancements are:

1. Oversize the neutral conductors to at least 150% of phase conductor current rating.
2. Install isolation transformers close to the harmonic load-generating device.
3. De-rate transformers, and motors.
4. Utilize true RMS relays and circuit breaker trip units.
5. Utilize line filters.

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