



AT ISSUE: ▼

In recent years, harmonic loads on distribution systems (in which currents at higher-frequency multiples of the fundamental 60Hz frequency add to the fundamental current) have increased dramatically due to the increased use of ferromagnetic devices (motors, transformers), arcing devices (fluorescent lighting, welders) and electric power converters (adjustable-speed drives, UPS, SCR devices). Such higher frequency loads increase the heat generated within transformer windings and leads by as much as 300%. This can lead to premature failure of standard-design distribution transformers.



RECOMMENDATION: ▼

Specify transformers with harmonic-resistant designs for applications subject to harmonic loads. Standard UL "K-factor" ratings can be used, or, better still, units can be custom-designed for the intended load.



Field measurement (magnitude and frequency spectrum) and harmonic analysis of the connected load can be performed by Cooper Power Systems' Engineering Group or by a third-party consultant to help identify your needs and define your transformer specification requirements.



If the harmonic-resistant transformer is being specified for a new equipment installation, the manufacturer of the equipment being installed should know the harmonic load content of that equipment. This harmonic information should also be included in the transformer specification.



RATIONALE: ▼

DESIGN

Harmonic-resistant designs are strengthened to maintain normal temperature rise under harmonic, full-load conditions.



Typical features of Cooper harmonic-resistant designs include:

- * Heavier conductors, leads, and neutral buswork to handle harmonic currents.
- * Extra cooling ducts within the coil, use of liquid dielectric, and additional external cooling to dissipate the additional heat.
- * Reduced core flux density to keep harmonically-induced overvoltages from drawing excessive excitation current.
- * Delta-connected primary windings to block the in-phase third harmonics from passing through the transformer.



THE BOTTOM LINE: ▼

Choosing transformer designs from a field with pre-defined, standard K-factor increments can sometimes result in unnecessary costs when the "next-highest" K-factor must be chosen for a calculated harmonic load. Settling for standard K-factor ratings is not necessary.

Cooper Power Systems engineers can design a transformer to fit the exact harmonic spectrum of an application. This allows each customer to purchase the exact amount of harmonic load capability needed to operate at full kVA rating under the harmonic loading conditions specified for the job.

