
The Devil in the Details

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This month we step outside the confines of Ask the Experts to address topics covered in previous power quality articles. John DeDad, editorial director of EC&M, clarifies some points made by fellow Ask the Experts veteran, Mark McGranaghan. And Dan Carnovale, Eaton/Cutler-Hammer's power quality solution manager, responds to questions concerning his article published in June.

Q. An article in the August issue of *EC&M*, "Controlling Harmonics Locally in Commercial Facilities," lists benefits and disadvantages of various filters. I'm particularly concerned with the section on neutral blocking filters, as I have installed a number of these filters in my facility over a period of four years. I've had no problems with any of my mixed loads. However, the article says that these filters may compromise the fault protection of my system and should not be used with mixed loads because of the potential for voltage distortion. Should I worry?

DeDad's answer: NEC experts at the International Association of Electrical Inspectors (IAEI) have thoroughly investigated the neutral blocking filter and its application. In fact, an article published in the January/February 2003 issue of the *IAEI News*, "The 3rd-Harmonic Blocking Filter, A Well Established Approach to Harmonic Current Mitigation," outlines all aspects of the Code requirements that apply to the filter and pays particular attention to grounding issues. The filter is shown to meet all Code requirements and won't affect the fault protection integrity of your system.

Your concern may have been prompted by the article's somewhat unclear discussion of the differences between systems serving phase-to-neutral, single-phase loads and those serving 3-phase loads. The 5th harmonic voltage distortion is quite damaging to 3-phase motors. This phenomenon is discussed in an article published in the November 2002 issue of *EC&M*, "Harmonic Current Distortion and Voltage Distortion." Further research shows that this valid concern about 5th harmonic voltage distortion and 3-phase motors shouldn't translate into concern about 3rd harmonic voltage distortion for mixed single-phase loads.

The correct application of neutral blocking filters results in increased 3rd harmonic voltage distortion, which appears on the voltage waveform as "flat-topping." This distortion has existed in 120/208V distribution systems — even without neutral blocking filters — for several decades with no documented evidence of damage to any type of load. Nor is there any evidence of damage in systems where these filters have been in use for many years.

Since 3-phase motors don't use the neutral, they're not affected by a filter that's inserted in the neutral of the distribution system.

Further, a manufacturer-commissioned modeling study noted in an August 2001 research report titled "Neutralizer Harmonic Blocking Device Study," by Alexander Emanuel, Worcester Polytechnic Institute, showed that the effect of 3rd harmonic voltage on small single-phase motors is negligible.

In contrast to these concerns, the effect of 3rd harmonic voltages on computer power supplies was shown to be beneficial as the efficiency of the supplies is increased in PQTN Brief 20, "Energy Use of Personal Computers," prepared by EPRI-PEAC in May 1994.