TransMax® vs. Zig-Zag

It has been suggested the **TransMax Harmonic Suppression System** (**HSS**®), can be replaced with a Harmonic Mitigating Transformers (HMT). Harmonic mitigating transformers come under many trade names. Whatever the name, these transformers are all basically zig-zag transformers that have a very low secondary impedance to zero sequence harmonic currents. The HMTs are claimed to be equivalent to the HSS. Outlined in the following are numerous reasons why HMTs are not equivalent and should be rejected.

Outlined here are numerous reasons why Harmonic Mitigating Transformers (HMTs) are not equivalent to Harmonic Limited's TransMax Harmonic Suppression System (HSS)

1. Harmonic cancellation:

a. The HSS operates by blocking the flow of 3rd harmonic current in the neutral wire. This prevents the flow of harmonic currents in both phase and neutral wires from the transformer oft to the furthest outlet. The 3rd harmonic currents are never formed in the system.

b. The HMT operates by canceling the 3rd harmonic current in a specially wound zig-zag secondary winding. This prevents the harmonic current from circulating in the transformer delta primary winding, but has no effect on the phase and neutral currents flowing in the electrical system downstream of the transformer. The 3rd harmonic currents flow in every phase and neutral wire,circuit breaker, and to every outlet in the system. These currents are mitigated only within the transformer itself.

2. Special Wiring:

a. Since 3rd harmonic currents never exist in an electrical system using the HSS,there is no need to increase wire size, double neutral wires, or run an individual neutral wire for each phase wire.

b. The HMT permits 3rd harmonic current flow throughout the electrical system therefore double or individual neutral wires are recommended. The transformer is constructed with double lugs for the neutral wire.

3. Increased usable capacity:

a. The HSS, by removing 3rd harmonic currents from the entire electrical system reduces the rms current throughout the system. Since the system is rms current limited, use of the HSS results in increased usable system capacity. More electrical loads can be connected without overloading the system.

b. Since the HMT permits the continued flow of 3rd harmonic currents, its use provides no increase in the number of loads that can be connected.

4. Lower heat production:

a. With the 3rd harmonic currents removed from the entire electrical system, the I^2R losses due to high harmonic current flow in wires, switchgear and transformers are lowered. Transformer temperatures are reduced. Transformer temperature reduction of as much as 39°C has been observed in the field.

b. Since the HMT does not prevent 3rd harmonic current flow throughout the electrical system, and removes these currents only within the transformer windings, I^2R losses are high and transformer operating temperatures are high.

5. K-rating:

a. The HSS removes the reason for K-rated transformers, the need to withstand high heat produced by the flow of 3rd harmonic currents. Therefore standard transformers are provided with the HSS.

b. The HMT transformer must withstand high neutral currents as well as increased rms phase currents due to 3rd harmonic current flow. The HMT is type K according to the name plate.

6. Transformer impedance:

a. The standard transformer used with the HSS has an impedance of 4% to 6%.In a refereed paper[1] presented at the international Conference on Harmonics and Quality Power (ICHQPS) conference it is shown that the lower the impedance of a transformer serving harmonic producing loads, the higher the harmonic currents flowing in the system.

b. The HMT has an extremely low (0.95% to the 3rd harmonic and 3.2% to the fundamental) impedance. Data show that the zig-zag transformer permits more harmonic current to the flow in the system than a standard transformer.

7. Energy consumption:

a. A system using the HSS has been documented to use less energy than thesame system using a zig-zag transformer[2]. When the HSS was added to an installed zig-zag transformer, energy consumption decreased by over 4%.

b. Due to the fact that the HMT permits high 3rd harmonic currents to flow in the distribution system, energy consumption of such a system is higher than that in a system using the HSS.

c. The transformers included in the TransMax product are premium transformers featuring:

i. DOE-2016 Efficiency Standard
ii. Copper or aluminum windings
iii. Low 115°C rise with a 80°C rise option
iv. Electrostatic shielding

8. Summary:

a. The HSS reduces 3rd harmonic current throughout the entire electrical distribution system from the transformer to the furthest outlet. Usable system capacity is increased, heat losses are reduced, and energy consumption is lowered. There is no need for special k-rated transformers or increased wire size.

b. The HMT does not reduce 3rd harmonic current throughout the entire electrical distribution system, and may, in fact, increase harmonic currents. There is no increase in usable system capacity, no reduction in energy consumption and special wiring, including double neutrals, is recommended.

There is no supporting evidence for the supposition that the HMT is the equivalent of the HSS for harmonic mitigation in an electrical system serving computer loads. All evidence shows that *the HMT is not equivalent to HSS technology*.

For further information contact us or see more information at harmonicslimited.com

[1] *Experimental Measurements of Energy Consumption Changes in a Wye Distribution System Serving Multiple Computer Loads as Various Harmonic Solutions are Applied,* Jonathan K. Piel and Michael Z. Lowenstein, presented at the ICHQPS 11th International Conference, September, 2004

[2] *Power Quality and Energy Analysis for Harmonics Limited*, Brian Fortenberry, EPRI/PEAC, February, 2003.