Application Note

SCENARIO: David is the engineer in charge of stamping operations at Peak Auto Plant #1. Two weeks ago, the plant's electrical supervisor found significant harmonics problems within the plant. And last week, the amount of downtime at the plant and product-quality issues had become so bad they had come to the attention of David's boss. Fuses and breakers were blowing, and machine controls were giving false readings—far out of normal ranges. David needed to understand the plant's harmonics problem better so he could find a way to fix the problems and improve overall quality.

Harmonic Mitigation Products

Key industries that benefit from Harmonic Mitigation Products

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- Food/Beverage/Brewery
- Municipal Water and Wastewater Treatment
- Paper Processing/ Printing/Publishing
- Petrochemical
- Pharmaceutical
- Rubber and Plastics
- Semiconductor Manufacturing
- Steel
- Textiles

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PROBLEM:

Harmonics

Addressing the Problem

David contacted an engineering service company to take a closer look at Peak Auto Plant's harmonics problems. The service company's power quality (PQ) energy adviser began by reviewing the plant's electrical single-line drawings to identify:

- Variable-speed drives and switchgear installed;
- Electronically controlled equipment present; and
- The level of harmonic content that might exist.

The adviser told David that certain orders of harmonics, created from non-linear loads, can cause serious equipment and system problems. For example, adjustable-speed drives, UPS systems, motor (soft) starters and other electronically controlled equipment such as CNC devices and programmable logic controllers, are sensitive to power amplifications—in current, voltage and frequency—from harmonics on the factory floor. That's why tripping breakers and blown fuses, as well as false controller data, had shut down part of the stamping operation twice last week.

Interruptions in production would continue, producing more quality problems, higher scrap rates and additional time and money for restarts—and could even shorten the life of Peak's electronically controlled equipment—unless the plant developed a plan to manage their harmonic-rich power system.

SOLUTION:

Installing an active harmonic filter system from Staco Energy to remove excessive harmonic content

Collecting the Data

The energy adviser continued evaluating Peak's harmonic problems by installing temporary instrumentation inside the plant. The data collected would be reviewed and used for computer modeling and simulations if necessary, so that the best solution could be designed. Engineers often design power-network models and run "what if" scenarios to size a tuned system's harmonic filter properly, and prevent negative effects on the equipment at the plant.

The adviser determined that some of the plant's new stamping equipment was contributing to a high concentration of harmonics—50 percent—in the 480 VAC power distribution system. A significant portion of the adverse harmonics had to be removed so Peak could reach an acceptable level of harmonic content as suggested by IEEE 519 guidelines.

The adviser recommended either a passive tuned filter system or an active harmonic filter from Staco Energy. Passive filter equipment would include iron-core reactors designed to meet Peak Auto Plant's particular problems in the 5th and 7th harmonic orders. Because this system would be engineered for Peak's individual requirements, a passive filter approach would be very effective in removing the harmonic content from the plant's electrical system. However, with the potential concern for higher order harmonics and the need for a "quick installation solution", active harmonic filters were selected. Because power factor correction was not required for the stamping operation, capacitors were not incorporated into the solution.

Once installed, the active harmonic filters reduced the targeted harmonics to acceptable levels. The solution gave David maximum uptime and allowed him to meet the quality standards for finished products.

The energy adviser also recommended that Peak consider using an active harmonic filter for future equipment or plant additions. Active filters mitigate a broad range of multiple harmonic orders—up to the 51st order. Staco Energy's active harmonic filter is a fast-response, power-electronics based device that injects and cancels harmonic currents using IGBTs (Insulated Gate Bipolar Transistors). The filter is sized for the corrected harmonic current, and units can be added over time as the company expands.

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