

CASE STUDY: Parallel Generation

GenMax Application Zook Generating Station, Leola, PA

Zook Molasses Company collaborated with Granger Energy Services to build the \$5 million Zook Generating Station in Leola, Pennsylvania. The 25,000 square foot facility creates 3.2 megawatts of electricity from two CAT 3520C 1600kW generators (0.75 pitch).

The Problem

The Zook generators were put in service around December of 2013 and ran, it appeared, without any issues until June of 2014. The harmonic content within the system was first noticed when the operators advised that the protective relay was tripping on. The event history report from the protective relay showed a significant imbalance between the currents of each phase which resulted in a “relay calculated” neutral/ground current near the neutral over current pickup setting.

Using the summation of the 3 phase vector addition to determine the neutral current value, an inconsistency between the generator power meter reading and the protective relays was discovered. The results were a generator power meter reading of 534.4 amps and the protective relays neutral current calculation of 239.5 amps.

At this point the only possible explanation for the difference between neutral current measurements was the presence of harmonics and the protective relay filtering them from its calculation. After confirming this protective relay filtering behavior and measuring the harmonic content within the neutral with a true-rms meter, the cause of the inconsistency between neutral current readings was identified as harmonics. The neutral harmonic current measurement was: THD 92.5%, rms current 536A, Harmonic Content (In order of greatest to least %): 3rd, 1st, 9th, 5th, 7th, 15th, 27th. Based on the data, the engineering firm tasked with the



project reasonably assumed that there were significant 3rd harmonic generating loads in the system and that each generator would need its own neutral harmonic filter.

The Challenge

In September of 2014 **Harmonics Limited** received the following email from the **Newkirk Electric Associates**.

“We are seeking advice/consultation in regards to a solution for the unusually high harmonic content measured within an electrical generation facility. Our main concern at the moment is the damage/stress that these high harmonic currents/voltages may have on our system over time and how we can eliminate or mitigate the damage/stress. The overall system is composed of (2) identical/mirrored configurations consisting a generator, switchboard, and step-up transformer which is connected to the utilities 12,470 / 7,200 distribution line. Each step-up transformer is a 3 phase transformer configured as a grounded wye – grounded wye. Each generator is rated for 1.6MW, 480V, and 2408 FLA. Both generators are solidly grounded wye generators. Within each switchboard contains the generator breaker, an MCC breaker (MCC contains a few VFD’s, (1) 50hp

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drive, and (3) 5hp drives), and (2) breakers that feed a nearby industrial customers (2) switchboards at ~900' away. The type of load being drawn by the industrial customer is unknown, but we do know that they draw ~800Amps at 480V.

After seeking support from several different harmonics consulting firms I was referred to your company's product, the GenMax, which after reading the information provided on your website, appears to be a potential solution."

The Solution

Newark Electric Associates consulted with the utility and was advised that line reactors were perhaps the answer. After further consideration and product performance evaluation, they decided to install a **GenMax** on each generator. The reasoning was that the **GenMax** is the only technology capable of eliminating the flow of the 3rd harmonic regardless of the source. By removing the high harmonic currents/voltages the **GenMax** negated the concerns of stress and damage to the system. As a passive system, **GenMax** needs no relays or switching devices, so preventive maintenance is not required in a 24/7 operating environment.

Installation was complete in April 2015.

The Results

After installation of the **GenMax**, Newkirk reported the current on the neutral was reduced from ~700Amps to ~120 with a drop in THD from ~13% to ~2%.

Several months later Newkirk Electric Associates Inc. ordered a third **GenMax** for use at a Granger-Honey Brook generation facility that was experiencing a similar circulating 3rd harmonic problem. It was installed in August of 2015. Both generation facilities are part of a Granger Energy Services project in eastern Pennsylvania.

The project was highlighted in the summer 2014 issue of *Cat RUNREADY*.