edition 8 | March 2018

POWER ELECTRONICS®

POWER NEWS

SUMMARY

Welcome

What an incredible start to 2018 – Weeks of incredibly hot and unseasonably humid weather followed up by ex Tropical Storm Fehi and Cyclone Gita. Truly a summer that had a touch of everything weather wise.

The summer period proved to be a busy time for the team at Power Electronics with many plants taking the opportunity to undertake upgrades and plant improvements, in particular power factor correction and automation projects. The bad weather also created some opportunities for us to demonstrate our ability to respond to customer's urgent requirements with our extensive stock levels proving to keep customers running. An example of this is profiled below.

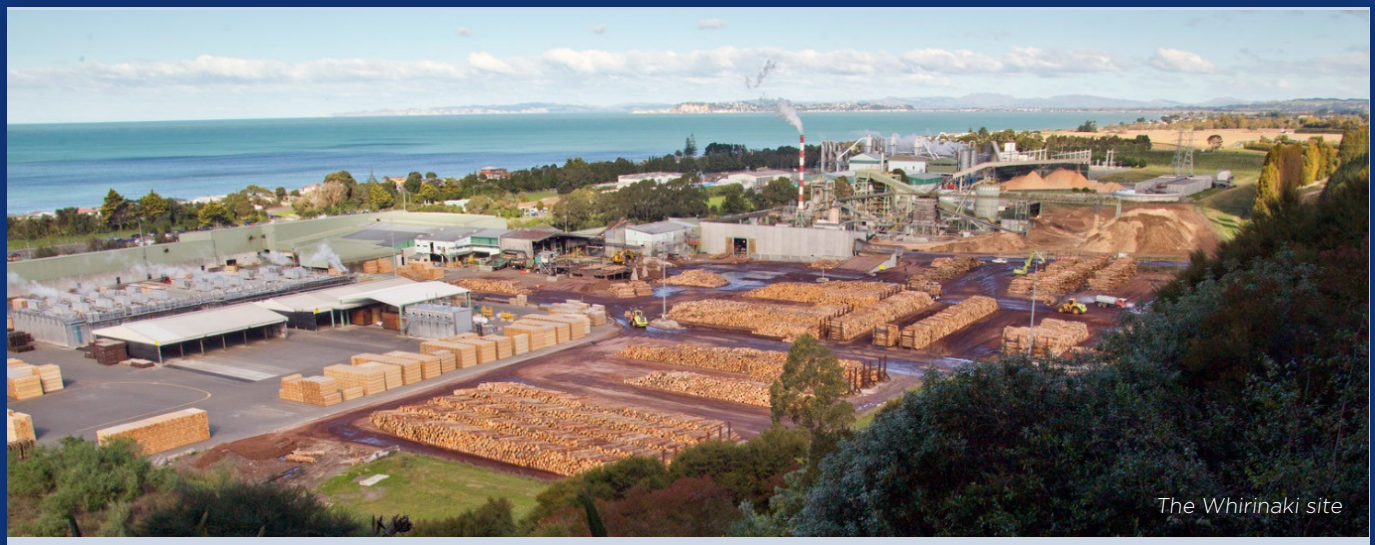
Our team is back to full strength after the holiday season, refreshed, raring, on the road, and ready to go, so don't hesitate to give us a call if you would like to catch up and discuss that VSD or power quality application.

All the best for the coming year!

SERVICE AND SUPPORT WHEN IT REALLY MATTERS

The SD7046055 is lifted up to the MCC

When the recent ex Tropical Storm Fehi hit the West Coast of the South Island, Westland Milk Products felt an immediate impact. Due to a number of local network faults the largest manufacturing site on the West Coast of the South Island was forced to restrict load to 1MVA. This was effectively a shutdown situation with only essential services able to be provided. Kerry Millar, Electrical Manager and his electrical team were working shifts around the clock to keep the plant alive until such time as normal supply could be restored. With production down, it was critical the team perform to a high standard under very trying circumstances. During start up checks on the plant's Dryer 2 it was found that a PDL Udi 480 VSD running the drier exhaust fan had failed and a replacement unit needed to be found ASAP. A text message was sent to Sales Engineer, Pat O'Dea, at 08:15 on the 5th Feb in an attempt to source a suitable drive. After a few initial checks regarding load type and physical dimensions our knight in shining armour, Operations and Technical Director, Brent Sheridan, loaded up a SD7046055 in the trusty Power Electronics Hilux and headed across the Southern Alps arriving on site at 12:15. This was a four-hour exercise from initial enquiry to delivery on site. The team at Westland Milk Products then removed the old PDL drive and set about the task of installing the new SD700. With the SD700 being very similar as far as power connections and commissioning process to the PDL drive, the most challenging task was removing the old drive and lifting the new drive into position. The Power Electronics PDL to SD700 conversion tool was utilised by Engineering Manager, Andy Buckley, to ensure that commissioning was trouble free and the team at Westland Milk Products were well prepared. The task was completed with the fan running later in the evening.



The Whirinaki site

PAN PAC'S 3.8MVAR POWER FACTOR CORRECTION PROJECT IS A WINNER

Situated a few kilometres north of Napier city is one of the region's largest industrial sites. Established more than forty years ago the Pan Pac Forest Products Whirinaki site has grown considerably over time. It comprises a pulp mill and a lumber mill and is one of Hawkes Bay's largest electricity consumers.

As the site Power Factor Correction (PFC) to the grid is corrected by the pulp mill 11KV synchronous refiner motors the site did not have any downstream PFC equipment in either the pulp or lumber mills.

The lumber mill is supplied from the site 11KV ring main and the lumber mill load had grown from an initial 1.7MW in 2002 to 4.0MW by 2015. This 2.3x increase in load presented a number of challenges; the lumber mill up stream power supply was at capacity, limiting any further growth, the lumber mill was experiencing voltage regulation issues ranging from 365V – 390V at times of heavy loading and high voltage issues ranging between 430V – 445V when the plant was down. Additionally, operational issues were being encountered - these included equipment tripping on under-voltage, lights going out when starting large motors etc. Also the poor power factor was increasing reticulation losses which resulted in switchgear, cables and transformers operating at elevated temperatures.

Site Electrical Engineers, Chris Needham and Kevin Burgess began their search for a solution. Chris with his overall site brief and Kevin looking specifically at the lumber mill requirements. Chris explains "Firstly we engaged consultants who undertook to build power system computer model that matched the lumber mill power situation, once this was done we were able to extrapolate that model to specify what correction was required to fix the problem and this model was also validated with on-line power measurements".

A number of options and technologies were considered as well as where this equipment would be best located. Chris mentioned "We initially considered correcting at the various 11KV transformers that supply the Lumber Mill, but the high cost of MV equipment, transformers, and switchgear soon eliminated this option."

The decision was made to place the PFC equipment at 8 main switch rooms throughout the lumber mill – on the 400V side of each transformer thus the correction was as close as possible to the loads and the benefits of the corrected PF were also being seen on the site LV reticulation equipment.

Kevin Burgess explained "We had already reviewed the technology options in earlier projects at our Otago site, where now we have two systems totalling 1,000 kVAr PFC installed. The Sinexcel Static Var Generators (SVG) units we selected were ideally suited for the highly dynamic load changes of the sawmill. The inverter based technology provides ultrafast compensation and maintains a constant PF of 0.99 at our Milburn site making the under and over compensation of our old switched capacitor systems a thing of the past".

Kevin also mentioned "In addition to the superior performance that the SVG system provides, health and safety at Pan Pac is a major consideration and the

PAN PAC'S 3.8MVAR POWER FACTOR CORRECTION PROJECT IS A WINNER CONT.

capacitor-less nature of the SVG system also eliminates the fire and explosion risks that conventional capacitor based PFC units can present".

The Whirinaki Site PFC project was launched in 2015 and was completed in 3 stages over a 24-month period. The project involved 8 locations totalling 3.8MVar of Sinexcel SVG equipment.

In a post project review meeting Chris and Kevin confirmed that the project was an outstanding success. Some of the points that they identified were:

- Lumber mill PF was raised from 0.6 – 0.7 to 0.98 – 0.99
- Reduction in total lumber mill MVA demand on the 11KV ring main by 30% (freeing up supply capacity at both the pulp mill and the lumber mill)
- Lumber mill voltage regulation is now 410V – 435V irrespective of mill loading
- The "ghost" events that could be attributed to poor voltage regulation that previously impacted production have virtually been eliminated
- The project was completed on time and within budget

Kevin Burgess checks the operation of one of the SVG systems

FREQUENTLY ASKED QUESTIONS

Where is the best place to remove harmonic currents?

The best place to remove harmonic currents is as close possible to the source i.e. the non-linear load that generates the harmonic currents or, alternately, at the sub-panels that supply the device. This removes the harmonic currents before they are drawn from the supply and associated distribution equipment.

Will a Sinexcel Active Harmonic Filter work on any brand of drive?

The Sinexcel range of AHFs are designed to work with any standard 6 pulse variable speed drive, in fact they are designed to work with any harmonic producing load. We just need to understand the magnitude of the harmonics we are correcting and what level you want to correct to. If you have any queries your best bet is to contact your local Power Electronics NZ representative to discuss your application further.

I have an old VSD that has been in stores for a few years. We need to power it up and use it for a job. Is there anything I need to do to it first?

The short answer to this is YES!

Modern VSDs use electrolytic capacitors as an integral part of the DC Bus. Electrolytic capacitors rely on a chemical process to provide the insulator between the two metal plates and this process can degrade over time.

To "reform" the capacitor - voltage should be applied slowly to the VSD input rectifier terminals. An easy way to do this is with a Variac. As a rule of thumb start with about 10% rated voltage, and increase in small increments over an extended period of time until full voltage is reached. On a big VSD this process may take up to 24hours before the capacitors are fully back to specification.

Always remember when working with capacitors that they can hold their charge for a long period of time. Forgetting this can be a painful, and potentially dangerous, lesson.

UNDERSTANDING THE EFFECTS OF HARMONICS – BACK TO BASICS

Harmonics, THDi, THDV, THDD – we have all heard the terms bandied around and it has been a "flavour of the month" subject of recent. Last week a customer asked "Is filtering harmonics really necessary? I still cannot get my head around how harmonics effects my customers and other consumers on the network? I am only putting filtering in because the network tells me I have to!" We sat down and had the following discussion.

Total Harmonic Distortion (THD) is at its most basic a measure of how much your load is distorting the perfect voltage waveform provided by your electricity supplier. THD is always present in current and voltage but too much distortion can cause problems.

We all know that non-linear loads, such as variable speed drives, draw currents at multiple frequencies (harmonics) of the fundamental frequency – in the case of NZ the fundamental supply frequency is 50Hz. These harmonic currents are drawn by the connected device, through the low voltage circuit and equipment connecting that device to the low voltage side of the transformer. These harmonic currents are then drawn from the generator thru the medium and high voltage supplies. The magnitude of harmonic current remains the same as a percentage across the transformer.

Problems that remain localized to site.

The obvious problem of carrying additional currents is overloading of cables, control, protection, and distribution. It is common to see cables operating hotter and burnt crimp lugs. Invariably this problem only effects the circuit passing the harmonic currents so is localized to the site with the offending equipment.

A solder lug overheated by high harmonic currents has melted the solder in the lug.

Problems that affect other consumers.

As electricity is distributed through the network there is an impedance between the generating source and the consumer. Typically the further you are away from the generator the higher your supply impedance will be. The harmonic currents interact with the impedance of the electrical network to create voltage distortion.

The voltage waveform is common to other consumers that are joined to the network at a point of common coupling. This can be either the low voltage side of the transformer if you are sharing a transformer with others, or if your site has its own transformer(s), the medium voltage network connecting the primary of the transformer. A distorted voltage waveform can effect:

1) Devices designed to work on a sinusoidal waveform, particularly devices relying on electromagnetism like motors, transformers, coils, induction hobs operate inefficiently and can burn out.

2) Devices containing solid state rectifiers, in particular SCR, can operate unreliably and fail prematurely as the zero crossing point of the waveform can be shifted.

3) Devices using the 50Hz waveform as a timing circuit can no longer function accurately. For example clock radios and oven clocks often loose time or run fast for no apparent reason.

Problems that affect the network company.

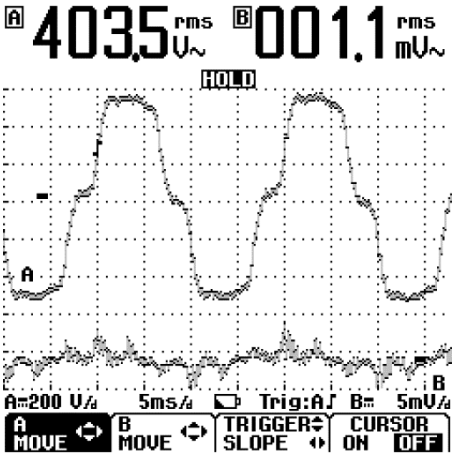
Like consumers the network company are affected negatively by increased harmonic currents. Their network must transport these harmonic currents. This takes up valuable network capacity because they are reactive power only and do no useful work. This causes additional volt drop and heating in their distribution equipment and a reduction in true power factor. They are also regularly involved in handling the fall out of customers who are being supplied a badly shaped voltage waveform because of someone else's harmonic producing load.

UNDERSTANDING THE EFFECTS OF HARMONICS – BACK TO BASICS CONT.

When does the problem get to a magnitude that I am likely to experience THDV issues on site

In order to preserve the quality of electricity the level of allowable voltage distortion which may be introduced into an electricity supply system by a consumer's installation is governed by the Electricity Regulations and NZ ECP36 - which state that the total harmonic voltage distortion at any point of common coupling with a nominal system voltage of less than 66 kV shall not exceed 5 percent. Some electrical networks have introduced local regulations which are stricter than this and state a maximum level of THDi that may drawn from the secondary side of the transformer.

Complying to any of these regulations does not guarantee that you will be free of issues created by THDV. You really need to measure THDV on your low voltage bus. Our experience shows that once you delve into the range of 8% to 10% THDV on the low voltage bus you can expect unexplained equipment failure, particularly electronics and power supplies, and the significant increased heating of electromagnetic devices.



A voltage trace of a supply showing in excess of 15% THDV. This site was experiencing random electronics failures and unexplainable production outages.

What do I do?

The good news is that harmonic currents, and hence harmonic voltage distortion, are reasonably easy to mitigate with either an active or passive filtering solution. Power Electronics have the test equipment and expertise to help if you suspect you have problems. Just contact your local Power Electronics office for further details.

POWER ELECTRONICS®

sales@power-electronics.co.nz

www.power-electronics.co.nz

Christchurch Head Office
(Southern Region)
14B Opawa Road
P.O. Box 1269
Christchurch
New Zealand

Phone: 03 379 9826
Fax: 03 379 9827

Napier
(Central Region)
Unit 1, 105 Ford Rd
Ford Road Business Park
Onekawa
Napier

Phone: 06 845 9067
Fax: 06 845 9046

Auckland
(Northern Region)
16 Aranui Rd
Mt Wellington
Auckland

Phone: 09 527 8523
Fax: 03 379 9827