edition 3 | October 2016

POWER ELECTRONICS®

# POWER NEWS

## SUMMARY



# Welcome

## to the latest edition of Power News.

It seems unthinkable but we are racing rapidly towards the end of the year. We already having inquiries from customers looking to organise equipment for shutdowns over the Christmas/New Year period.

2016 has been an incredibly busy time for Power Electronics. We have had good growth across the business, but in particular the power quality area. This has seen our staff levels grow yet again. In this edition there is an introduction for our newest Christchurch based team member.

Our planning for 2017 is already well underway and we have some exciting new variable speed drive products for release in the first half of the calendar year. Keep your eyes peeled!

We trust that you find this newsletter informative, and as always, if we can be of any assistance then please don't hesitate to ask.

## LOCAL SERVICE AND SUPPORT – WHAT DOES IT REALLY MEAN??

It seems to be the latest catch phrase – our support desk "follows the sun" or "our international help desk always has someone to take your call". But there is a big difference between answering a telephone and truly being able to provide you with specialist support. How can someone a world away really help you?

This isn't something you can contract out, or rely on someone in another country to make sure you get the assistance you need. When your plant stops you need to be able to talk to the right person - right now!

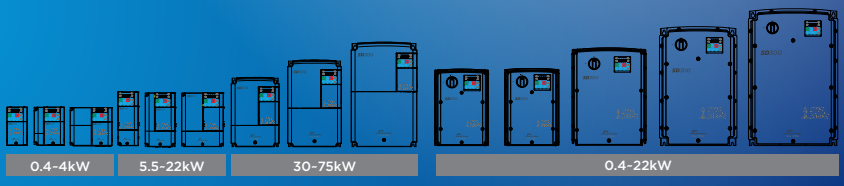
Our local service and support is what sets Power Electronics apart from our competitors.

At Power Electronics our New Zealand based support team are available 24/7 for urgent breakdown support. Whether it be for some assistance via the phone, or you need someone to attend site, there is always one of our staff to offer a hand. Our support team are specialists in AC motor control and power quality equipment, are factory trained, all have an industrial electrical background, and most importantly - understand the pressure that you are under to make that plant go.

*Power Electronics NZ based support team, pictured above; Andy Buckley and Jason Curtis. Below; Dave Lockett*

# SD300

COMING SOON!


- Available IP20 1 phase 230V 0.4kW to 2.2kW
  3 phase 400V 0.4kW to 75kW
- Available IP66 3 phase 400V 0.4kW to 22kW
- Integral Safe Torque Off (STO)
- Flexible Fieldwork Connectivity – (Profibus DP, Ethernet IP, Modbus TCP, CANopen)
- Dual Rating – Pump and Fan Duty and Heavy Duty
- Flange Mounting Option

POWER ELECTRONICS NEW ZEALAND

# SVG STATIC VAR GENERATOR MAXIMISES TEMPORARY SUPPLY CAPACITY

With the catch phrase "From garden gate to dinner plate", Gisborne based LeaderBrand Produce is a leading supplier of farm fresh produce to supermarkets throughout New Zealand. One of Leader Brand's main lines is their range of pre-prepared salads.

To accommodate increasing demand a new 4200 square metre green fields Salad Factory is presently under construction. Jack Jamieson, LeaderBrand Plant and Engineering Manager explains; "This Processing /storage facility is four times the size of our current facility and will enable greater efficiencies to be gained in all facets of the operation. It is anticipated that the new facility will enable us to produce and dispatch up to 3 times our current volume over a shorter daily production period".

In order to maintain production whilst the new factory is being built, the existing production facility needed to be kept running whilst the new factory is being constructed. The old plant will eventually form part of the overall complex.

Ben Webster of Industrial Maintenance Solutions, LeaderBrand's principal Electrical Design and Electrical Constructors for the job explained that; "A temporary supply was required because the existing 11kv supply cable and transformer was inside the new building footprint and relocation was not an option, due to cost and production disruption".

An adjacent 500KVA transformer was earmarked to supply the old factory however, its capacity was barely enough to supply the factory. In order be able to run the old plant off the transformer the power factor needed to be increased from 0.77 to as close to unity as possible. Also by improving the power factor, this would enable the size of the temporary mains cables to be kept to a minimum.

Power Electronics loaned IMS power analysing equipment and concluded from the data recorded at the site that 100kVAr of compensation would improve the Power Factor to close to unity and reduce the current that the plant would draw by around 70A. A 100kVAr SVG module was loaned by Power Electronics to the project for the duration of the construction phase. Ben said that "The loan unit has operated at 103% capacity continuously to maintain the power factor at 0.98 – a pretty impressive example of the equipment's capability".

The new factory will have 2 x PFC cubicles in the main switch room each containing 3 x 100kVAr rack modules. Jack Jamieson explains that "the modular configuration of the Sinecel SVG system is a perfect solution for us in that we can plug in extra modules into the cabinets as our new factory loads grow."

Key features and benefits of the LeaderBrand SVG system;

- Instantaneous power factor correction
- Step less control (no under / over shoot)
- Inverter technology eliminates the traditional maintenance associated with conventional Capacitor based PFC units
- Expandable due to plug in SVG modules

*The new plant under construction*

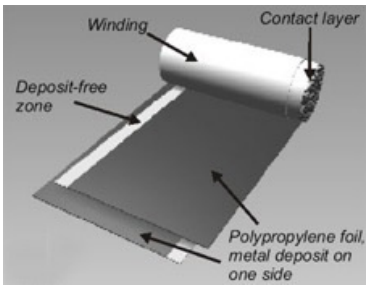
*The temporary SVG 100kVAr unit*

# POWER FACTOR CORRECTION – UNDERSTANDING THE ISSUES

**In our last newsletter we explained what is power factor correction and the advantages of installing power factor correction systems. We also delved into the pitfalls of using AC capacitors to achieve this. In this issue we will investigate in depth some of the failure mechanisms of an AC capacitor, namely Harmonics and Overloading, Temperature, and Terminal Overvoltage, and relate this back to the modern electrical environment to help understand why power factor (PF) capacitors failures appear to be on the increase.**

Capacitors are one of the few electrical loads that draw full rated current the moment they are connected to a voltage source. They are designed to operate at a specific voltage, a specific frequency, and have a maximum operating temperature. Operating the capacitor outside any of these specifications has a significant impact on capacitor life. To get a better appreciation of this it is important to understand how a modern power factor capacitor is constructed.

Most modern PF capacitors are of the metallised polypropelene film (MPP) type. They are built using layers of polypropelene, which is referred to as the dielectric, and is an insulating material. The thickness of this dielectric determines the capacitance of the device. This layer of polypropolene is then sprayed with a metal film on one side, normally Aluminium or Zinc. One of these dielectric and metal film sheets is required per phase so there are three sheets in a three phase capacitor. The three sheets are then rolled into a cylinder shape and an internal star or delta connection between the sheets is made. The cylinder shape is then inserted into a can. Oil is then placed in the can, typically a plant or castor oil, and this is done to help cooling and extend the capacitor life.




*An exploded drawing of an MPP capacitor. Modern MPP capacitors constructed in a cylinder format.*

### Harmonics and Overloading the Capacitor

So we stated above that a capacitor is one of the few electrical loads that draws full rated current the moment it is connected to a voltage source – so how is it possible to overload the capacitor? Remember that we also stated that a capacitor is designed to operate at a specific voltage, maximum operating temperature, and a specific frequency – and here in lies our problem.

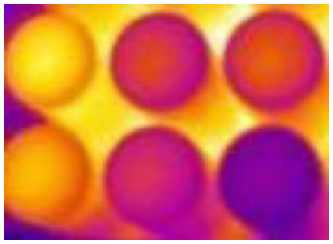
In our modern electrical environment where non-linear devices are connected (VSDs, UPS, LED etc) there are currents being drawn at frequencies other than, but multiples of, 50Hz. The capacitors present as a low impedance device to these high frequencies and literally try to absorb these harmonic currents.

As per most electrical loads the result of drawing excessive current is heat. The MPP sheets inside the capacitor raise in temperature, reducing the dielectric performance, heating the oil that is used for cooling, the oil produces gas, and the capacitor swells and fails. Some capacitors have a built in pressure disconnect to remove voltage connection to the MPP plates in the event of over pressure. Some capacitors do not and can literally fail due to the explosion of the pressurised can.


*A "bulging" capacitor due to excessive heat versus it's "normal" counterpart*

### Temperature

Ambient air temperature and ventilation design has a major impact on the life of PF capacitors. With the pressure to reduce expensive switchboard real estate, and to keep things as small as possible, the thermal design of PF systems is something that is often overlooked. Many PF systems are installed with capacitors in tight groupings which can result in reduced air flow to some of the capacitors within the group. It is also common to see PF systems that have no ventilation or forced cooling. Raising the temperature of the capacitor above its rating simply results in the dielectric breaking down.

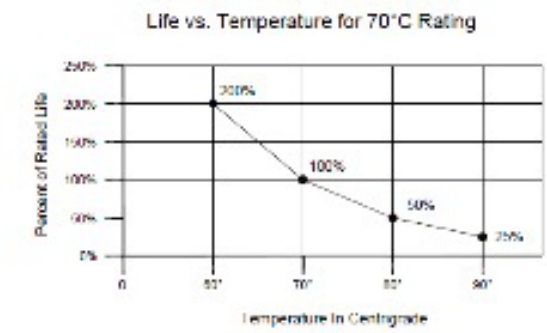


*Hot capacitors in a "capacitor tray" due to poor air flow*

*A capacitor that has "burst" through the side of the can and released pressurised gas that has caught fire*

## POWER FACTOR CORRECTION – UNDERSTANDING THE ISSUES CONTINUED

Capacitor life follows the Arrenhuis model . This is demonstrated on the chart below and shows that operating a capacitor at a temperature 10°C above its rating reduces the life of the capacitor by 50%. The indicators of failure for a capacitor exposed to over temperature are almost identical to that of a capacitor which has failed from an overload.




**Terminal Overvoltage**

MPP capacitors do not respond well to being supplied with voltage above their ratings. In fact the capacitor life expectancy is a function of the rated voltage divided by the terminal voltage. In theory it is very easy to select a capacitor with a suitable voltage rating. It simply needs to be rated at the voltage of your supply or higher – right? Unfortunately it is not quite this simple.

In order to try and prevent premature deterioration of PF capacitors through overvoltage many people put in higher voltage rated devices. The side effect of this that the correct kVAr for the Supply Voltage must be selected. As you can see from the picture below this capacitor is rated at 25kVAr at 690VAC and 50HZ. If this capacitor was selected to operate on 600VAC system, to offer more voltage headroom, it would only provide 18.9kVAr. If capacitor selection is not undertaken carefully it is possible to install a higher voltage rated device, thinking you are offering better system protection, but at the same time reducing the kVAr you have available for PF correction.


*A 690V rated capacitor showing the different kVAr ratings for varying voltages and frequencies*

This becomes particularly important when a traditional PF capacitor system is fitted with harmonic blocking chokes. The blocking chokes will normally prevent the 5th and 7th harmonic from being drawn into the capacitor. The side effect is that the voltage on the output of the blocking choke will be upwards of 10% higher than the supply voltage. When using blocking chokes special care should be taken to ensure that capacitor voltage and kVAr ratings are correct for this increased terminal voltage.

**Why does the SVG not suffer these problems**

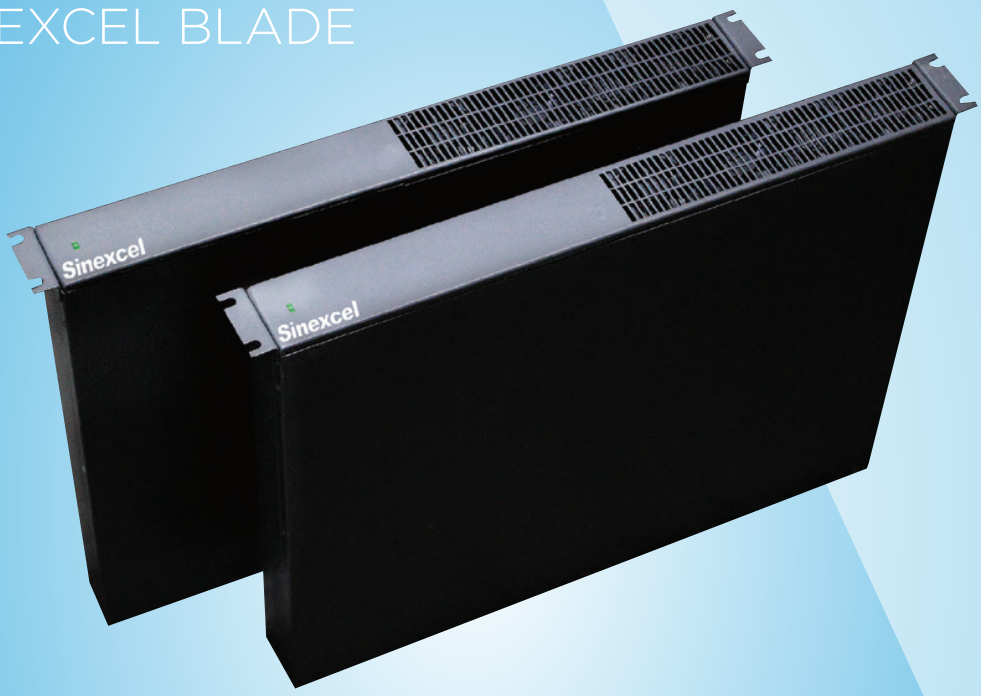
The SVG corrects power factor by using 3 level inverter technology. The SVG is used as a kVAr exchange and achieves this by the controlled switching of the 12 IGBTs within the inverter. NO AC CAPACITORS ARE USED IN THE SVG so the above problems do not occur.

In the next edition we will cover the effects of transient voltages (particularly relating to the switching in and out of capacitor banks in a PF system), resonance, and the side effects of the "self healing" properties of modern capacitors. Keep your eyes open!

## INTRODUCTION OF A NEW STAFF MEMBER

Power Electronics are pleased to announce the appointment of Pat O'Dea as a South Island based Sales Engineer. Pat has years of heavy industrial electrical experience in New Zealand and overseas as both a hands on electrician and in various management roles. Pat has held the position of engineering manager for a large manufacturing plant so understands the importance of after sales service and support at a customer level. He also has a sound understanding of the network utility industry having worked in this sector for a number of years as a Substation Technician and Inspector. Outside of work he enjoys spending time with his two children, surfing or riding his motorbike. Originally from Westport Pat has relocated to Christchurch and will be based in the Christchurch head office. He can be contacted on 027 702 6130 or podea@power-electronics.co.nz

# A BREAK THROUGH IN COMPACT AHF TECHNOLOGY – THE SINEXCEL BLADE




Finally a compact Active Harmonic Filter suitable for low power applications or distributed correction.
High power AHFs are used to correct harmonics at a centralised point – often the main switchboard. The Sinexcel Blade AHF is designed to allow for harmonic correction at the harmonic source – removing harmonic currents from all sub-circuits and associated switching devices, further protecting the installation from overloading and nuisance tripping.

To achieve this performance in such a compact frame the Sinexcel Blade utilises the latest power semi-conductor switching technology.

- Silicon Carbide semi-conductors allows switching frequencies of up to 90kHz – 4.5 times faster than traditional IGBT technology
- Harmonic filtering from the 2nd to 61st harmonic
- Ultra-compact size allows for easy installation
- Fast switching technology results in an almost pure sine wave output with minimal filtering required
- Configuration over WiFi
- Available in 5A, 10A, and 15A module

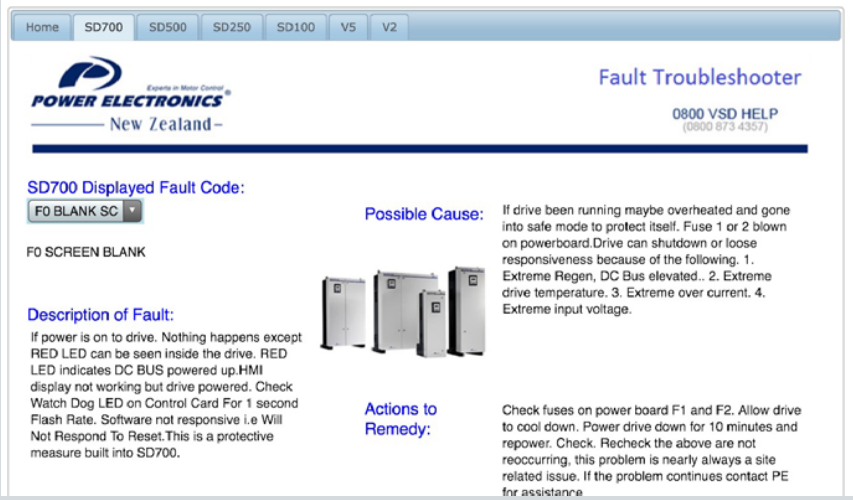
*The new compact Blade AHF – similar in size to your average laptop.*

# FREQUENTLY ASKED QUESTIONS

## Can I get someone to help me assess my power factor and harmonic requirements?

Power Electronics are able to assist with onsite support to help determine your actual power factor and harmonic filtering requirements. This can be done at a number of levels including assisting your electrical staff to capture site raw data with our specialised power quality metering equipment thru a full power quality report undertaken by our engineering team. The data captured from site is then compared to local and national harmonic regulations and power factor requirements, often including your energy account structure to calculate any savings, and the best solution is put forward for your application.

## I never seem to have the right manual with me for finding VSD and SS fault details. Is there somewhere I can get fault details for all the products?




YES – There is a fault code "App" available from the new Power Electronics website that can be downloaded for IOS or Android phones and tablets. It contains all the VSD and SS models, a description of all there faults and suggested actions to remedy. This is only downloadable from http://www.power-electronics.co.nz/support/tools/ and is not currently available from App stores.

## If I am making allowance for a new building or plant how do I know what my power factor and harmonic requirements will be?

Historically many people have just used rules of thumb to determine power factor and harmonic requirements. With the new electrical load profile containing such a mixture of linear and non-linear loads it is prudent to model the PF and harmonic profile for each new building or plant. Our experienced engineering team can run a model for you based on the type of loads that will be installed. This will give you a much more accurate indication of your actual requirements.

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