PFC Engineering Ltd
Station Road, Great Chesterford, Essex
CB10 1NY
Tel: 01799 530728
Email: enquiries@pfc-engineering.com
Web: www.pfc-engineering.com

Power Factor Correction **Power Quality** **Energy Solutions**

POWER FACTOR CORRECTION -
A LOW COST ALTERNATIVE TO SUPPLY UPGRADE

OVERVIEW

A specialist manufacturer of components for use in the final manufacture of gas fuelled products initially contacted PFC Engineering following a basic load check they had carried out due to the recurrent failure of their main electricity supply fuses. This resulted in severe disruption to production with the factory regularly having to shut down until the supply fuses could be replaced. The site was faced with the prospect of supply upgrade costs in excess of £50,000 or relocation. Furthermore, they could not understand why, during periods when the plant was idle, the check showed the plant demand was consistently nearly 50Amps.

Following initial consultation with the client, our engineers thought it possible that the supply had a fixed Power Factor Correction (PFC) capacitor connected which was operational regardless of the site loading that the client was unaware of. Our engineers attended site to carry out further investigation and were able to confirm that this was indeed the case; an unidentified innocuous metal box was connected to the main bus bar chamber containing a number of capacitors which were delivering 35kVAr (48.7Amps at 415V) in total. The Plant Manager commented “I had no idea what it was, it’s always been there”. Whilst on site, we also identified a 75kVAr rated automatic PFC system which had failed due to extensive component failure.

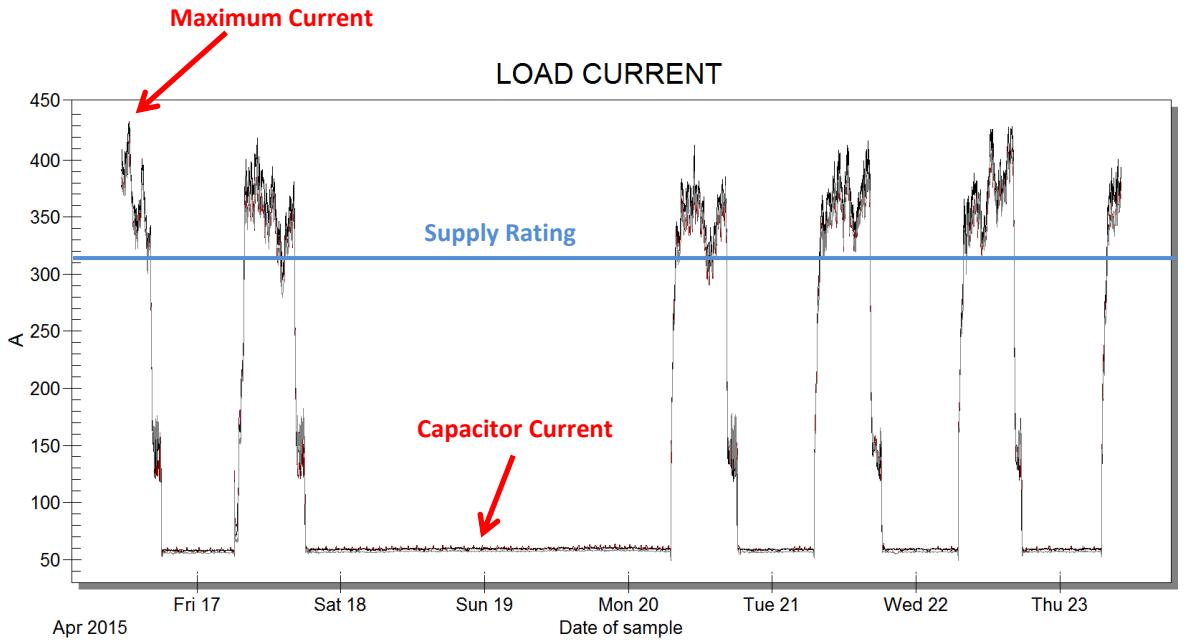
Our further site investigations found that the main supply fuses were rated at 315Amps and whilst on site, we had observed operating currents which regularly exceeded 400Amps! The reason for the supply fuses operating was obvious! In view of this, we connected one of our Power Quality Analysers to monitor all of the site load parameters for 7 days. Before leaving site, at the suggestion of our engineers, a large fan was set up to blow cool air on to the main supply fuse-switch in a short-term attempt to reduce the regularity of the fuses operating whilst we carried out our analysis and suggest solutions. A little “Heath Robinson” perhaps? However, it transpired that this was very effective.

Following our analysis, the results were collated and we found that the plant “steady-state” current had reached over 430Amps as can be seen from the current profile graph below (Fig 1). The current flowing into the fixed capacitor can clearly be seen during evenings and weekends.

Our load analysis also recovered details of the power consumed on site and from this, we were able to identify that at “Maximum Demand” the site was operating at a power factor of just **0.724** (Fig 2) and that almost as much Reactive (kVAr or magnetising) power was being consumed as Active (kW or useful) power as illustrated in Fig 3. As a result, the total (kVA or Apparent) power being drawn from the system rose to a maximum of nearly 300kVA (Fig 4).

RESULTS

Fig 1

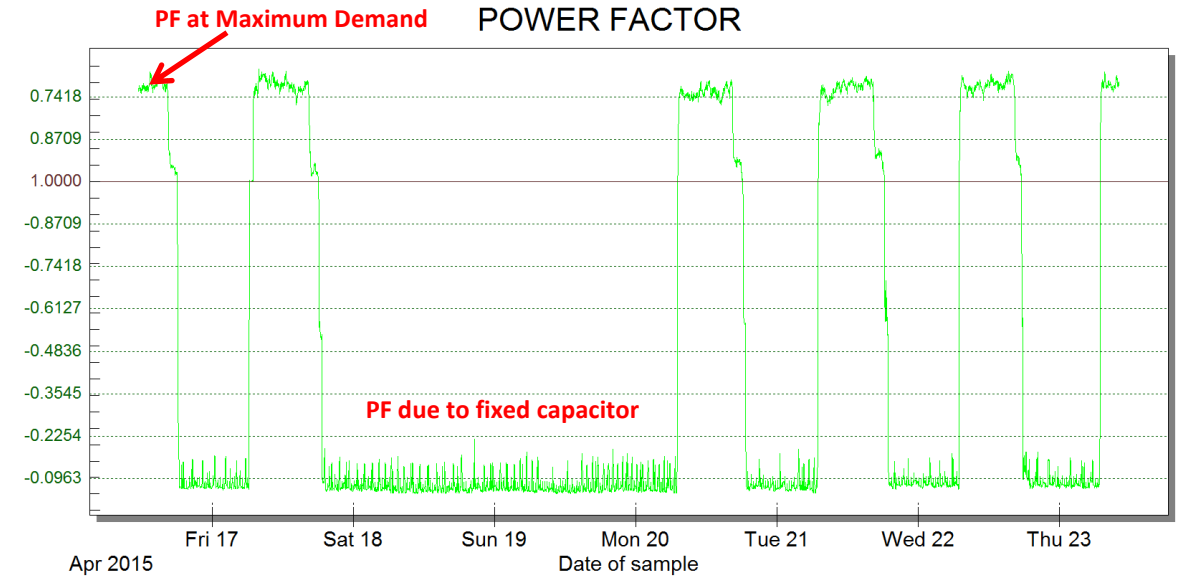


Act : 16/04/2015 12:40:00
Act : 430.11 (A)

From : 16/04/2015 11:24:00
Maximum : 430.11 (A)

To : 23/04/2015 10:10:00
Minimum : 48.18 (A)

Fig 2

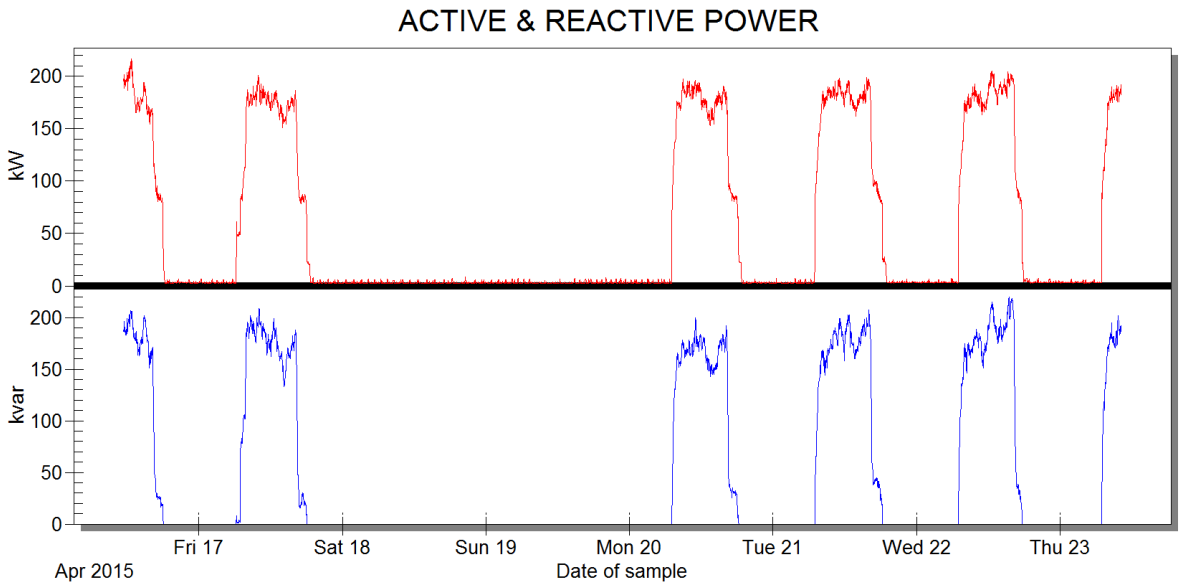


Act : 16/04/2015 12:40:00
Act : 0.724

From : 16/04/2015 11:24:00
Maximum : 0.658

To : 23/04/2015 10:10:00
Minimum : -0.051

Fig 3

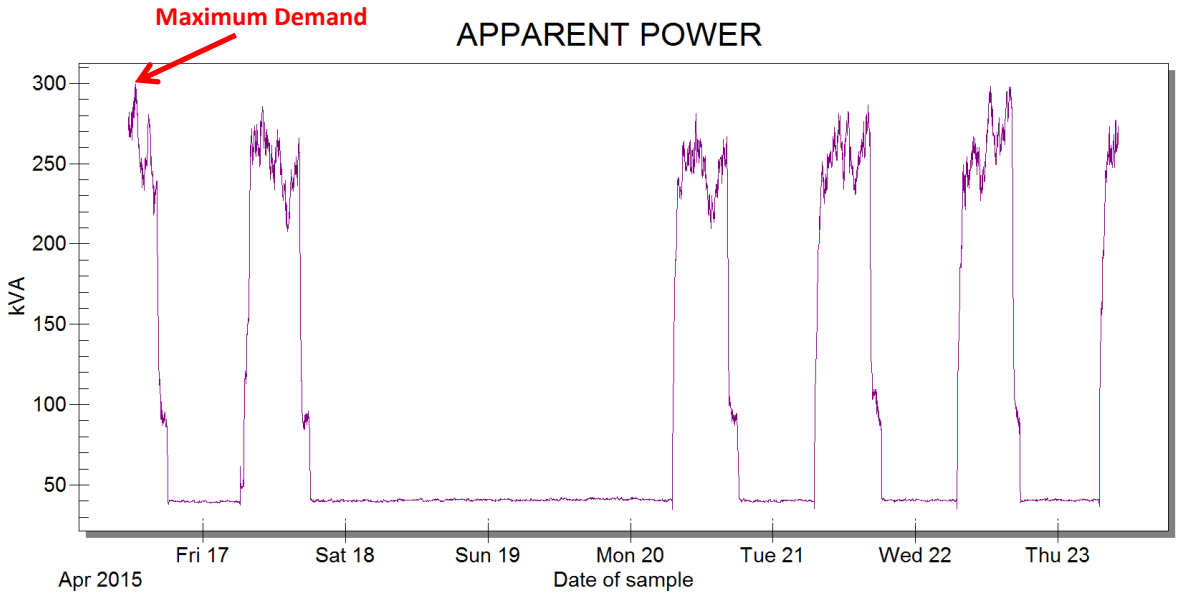


Act : 16/04/2015 12:40:00
Act : 216.56 (kW)

From : 16/04/2015 11:24:00
Maximum : 216.56 (kW)

To : 23/04/2015 10:10:00
Minimum : 2.07 (kW)

Fig 4



Act : 16/04/2015 12:40:00
Act : 299.47 (kVA)

From : 16/04/2015 11:24:00
Maximum : 299.47 (kVA)

To : 23/04/2015 10:10:00
Minimum : 34.79 (kVA)

Maximum Demand Loading

Based on the results of our load analysis, the following Maximum Demand condition occurred.

	kVA	**kW**	**kVAr**	**PF**
16/04/2015 @ 12.40Hrs	299.47	216.8	0.724	206.6

RECOMMENDATIONS

Based on the results of our load analysis and further discussions with the client, our engineers recommended the following measures to minimise the site loading:

- Strip out the existing failed 75kVAr automatic PFC unit and repopulate the enclosure with a total of 108kVAr of our SBA type modules and a new multi-stage control relay
- Install a new 108kVAr rated Vector FS100 “Slave” unit which would be controlled via the above
- Remove the fixed capacitor to avoid excessive Reactive power consumption during periods of light load
- Install a 3-phase multi parameter load meter to provide site engineering staff with instantaneous site load, demand and consumption data. An audio/visual alarm unit was also connected via an output relay of the proposed load meter to act as a “Maximum Demand Alarm” to warn of impending supply overload

RESULTS

Our engineers carried out the above recommended works approximately 1 month after our analysis at a cost of circa £5,000. Post installation, during a period of similar site loading as pre installation, the following improved maximum demand condition was recorded.

	kVA	**kW**	**PF**	**kVAr**
02/06/2015 @ 11.55Hrs	210.3	210	0.999	11

The above improved load condition represents a reduction of approximately 89kVA or 125Amps at the site operating voltage; subtracting this from our previously recorded maximum current would equate to 305Amps enabling the main supply fuses to operate within their rated load. Since our installation the supply has not failed once and the client has been able to continue with manufacture uninterrupted and avoid costly supply upgrade or site relocation.

Although the principal reason that Power Factor Correction was recommended for this site was to reduce the burden on the electricity supply infrastructure, there was a secondary financial benefit too. Improving the operating power factor to almost unity resulted in savings of nearly £1,500 per annum on Excess Capacity and Reactive Power charges, representing a return on investment of approximately 3.3 years.

Based on the findings of a study commissioned by BEAMA, this PFC installation will also result in a reduction in CO_2 emissions of over 31,500kg per annum.

If you are interested in finding out if Power Factor Correction could benefit your company, please contact our engineering team at enquiries@pfc-engineering.com