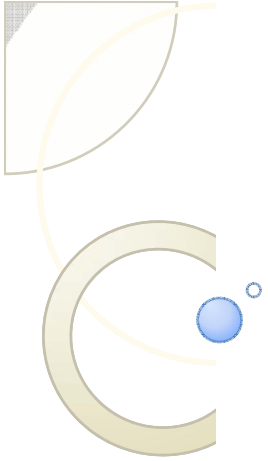


Power Quality Issue in Weld Shops

3PCC MLT

4PCC MLT

PCC10

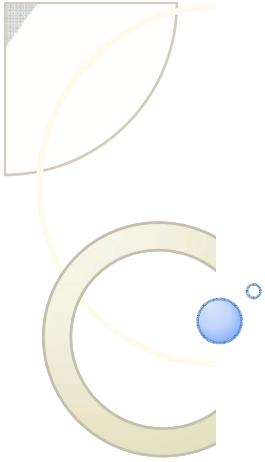


Nature of issues

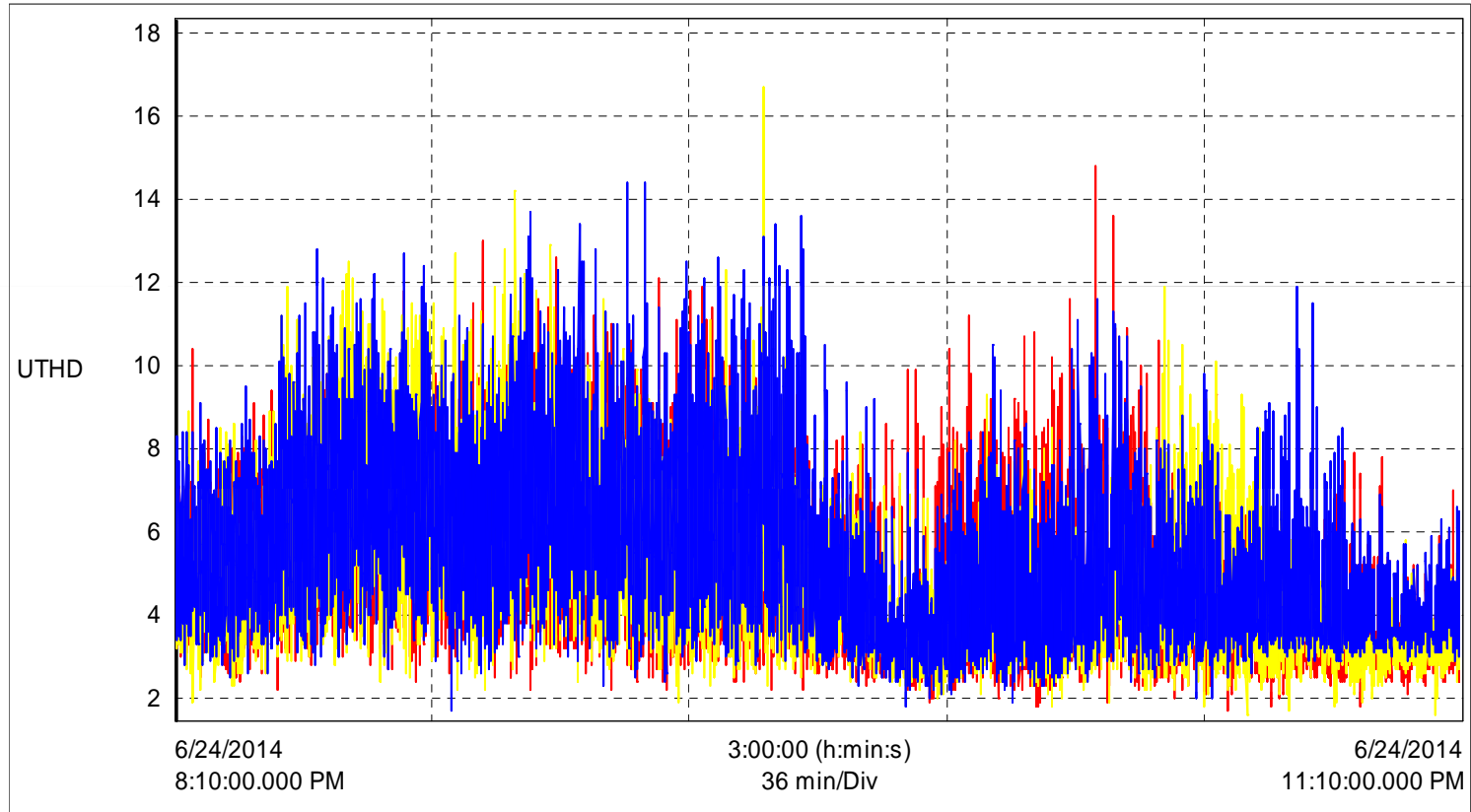
Issue in maintaining Unity power factor.

Issue of High Current Harmonics & Voltage Harmonics.

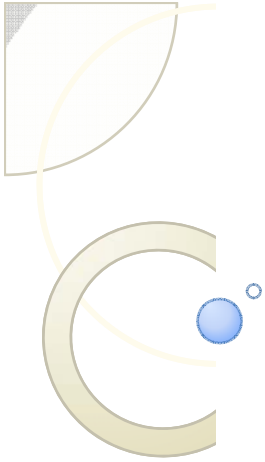
Other issues if any, related to welding quality, automation etc.



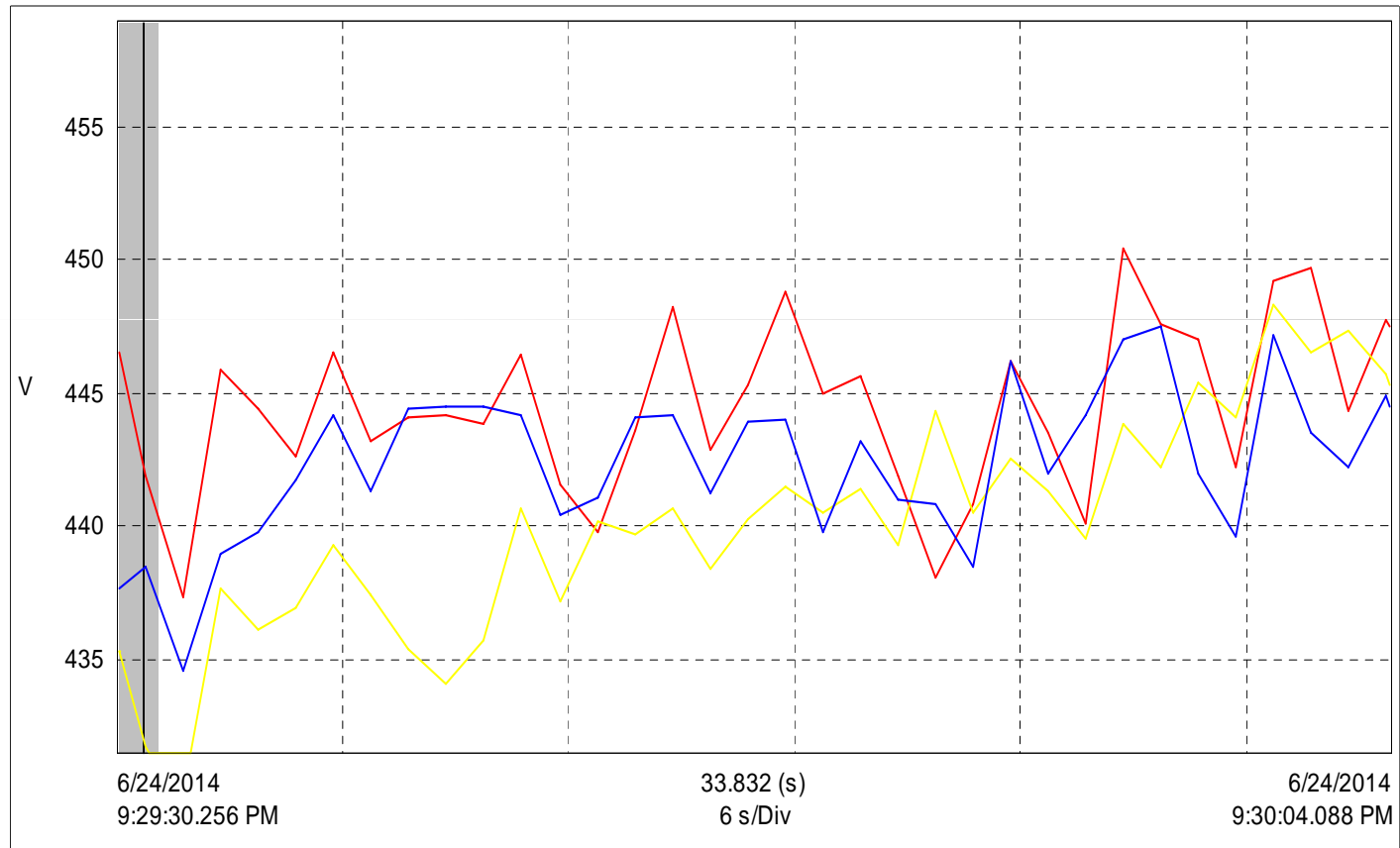
Our observations



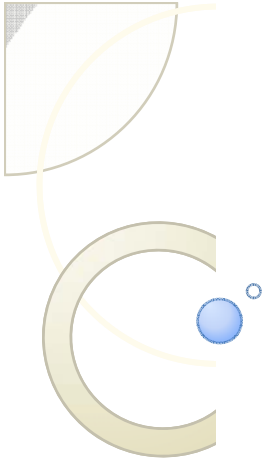
Distorted Transformer Secondary Voltage



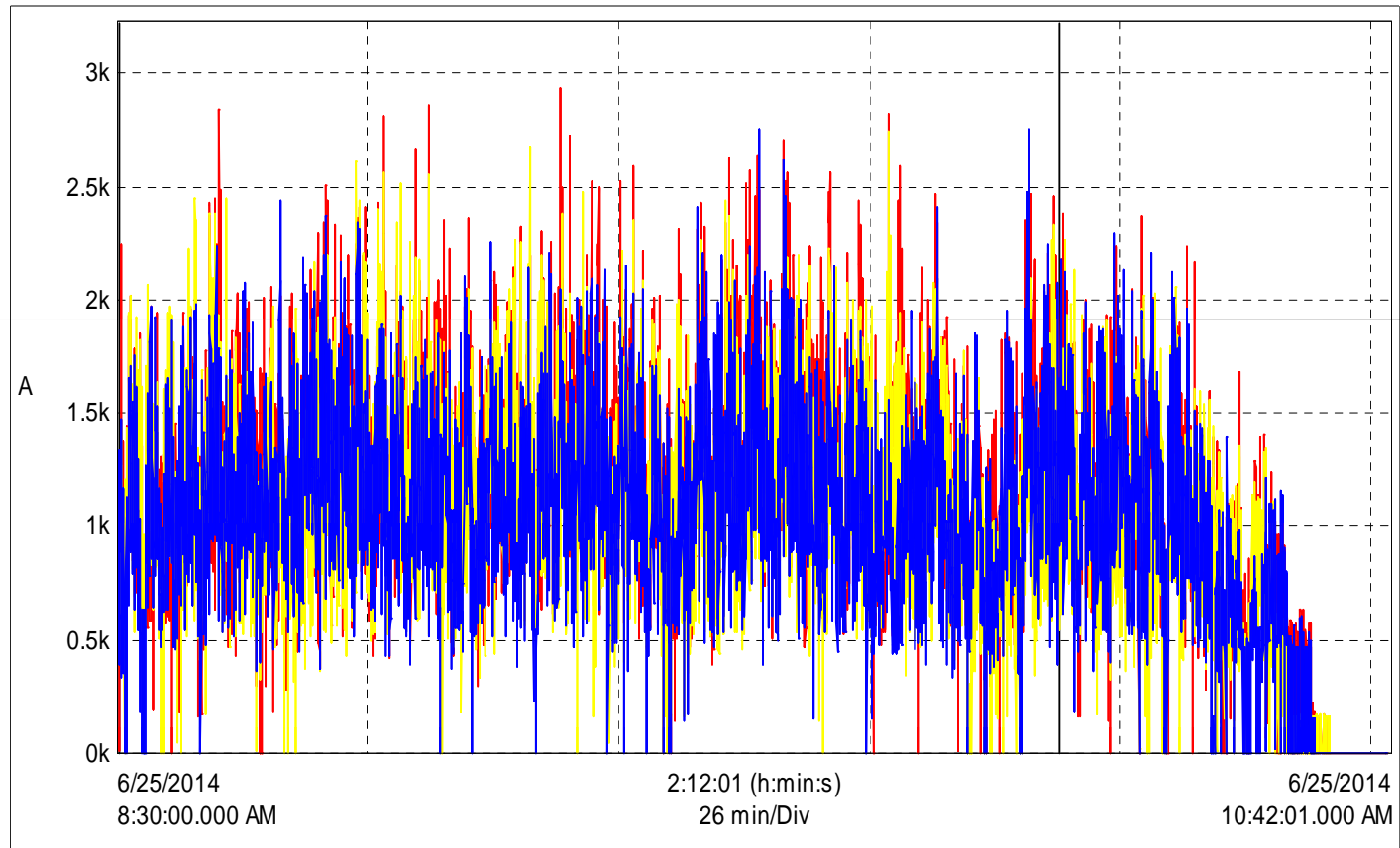
Our observations



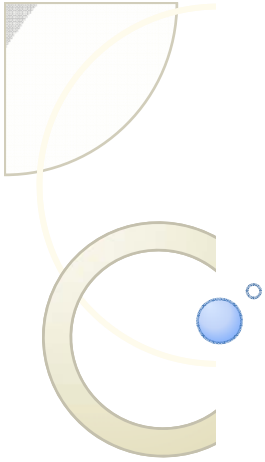
Flicker on Transformer Secondary Voltage



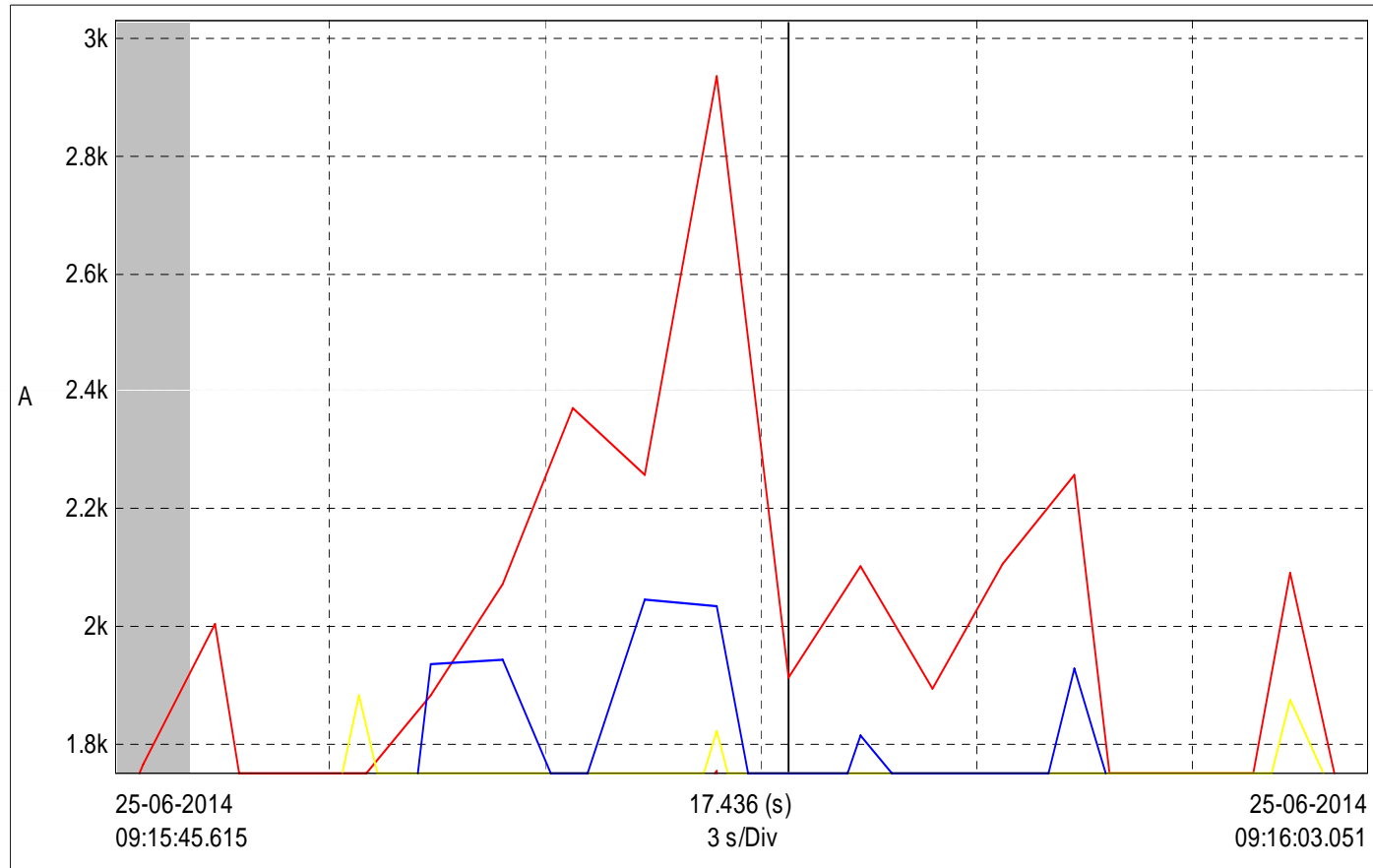
Our observations



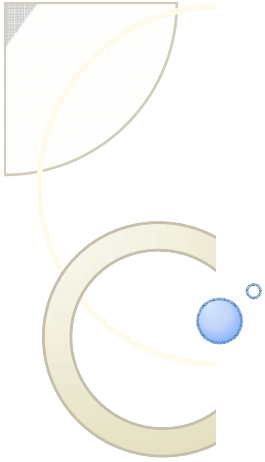
Load current peaks of 3000A required frequently



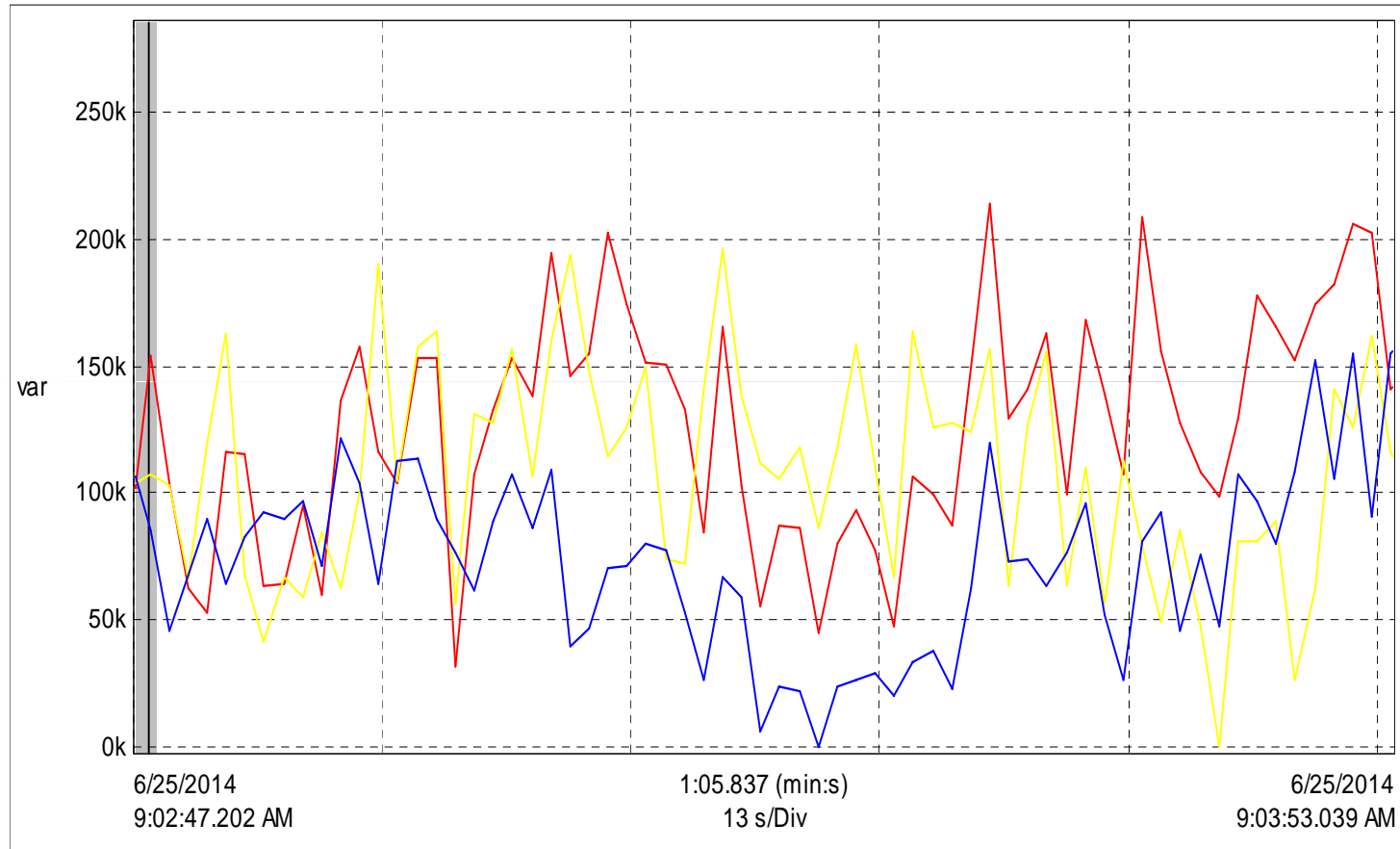
Our observations



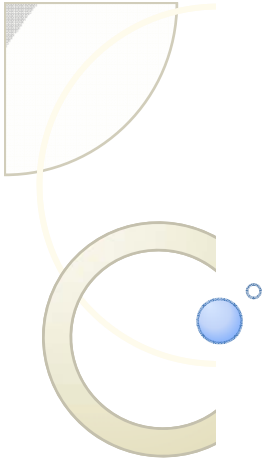
Abnormal Load current peaks due to 2 phase welding + Imbalance loading



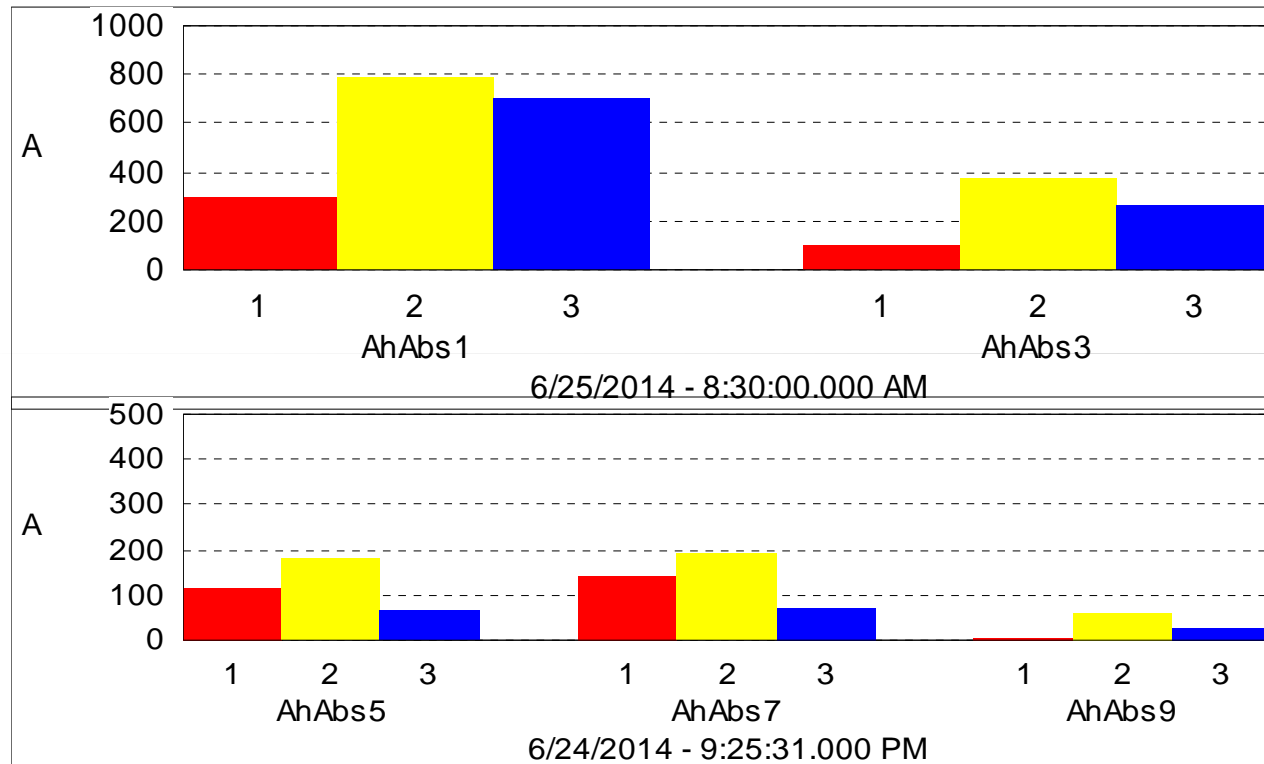
Our observations



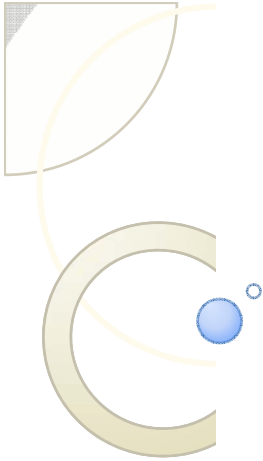
*KVAR requirement is different in each phase
(With respect to time)*



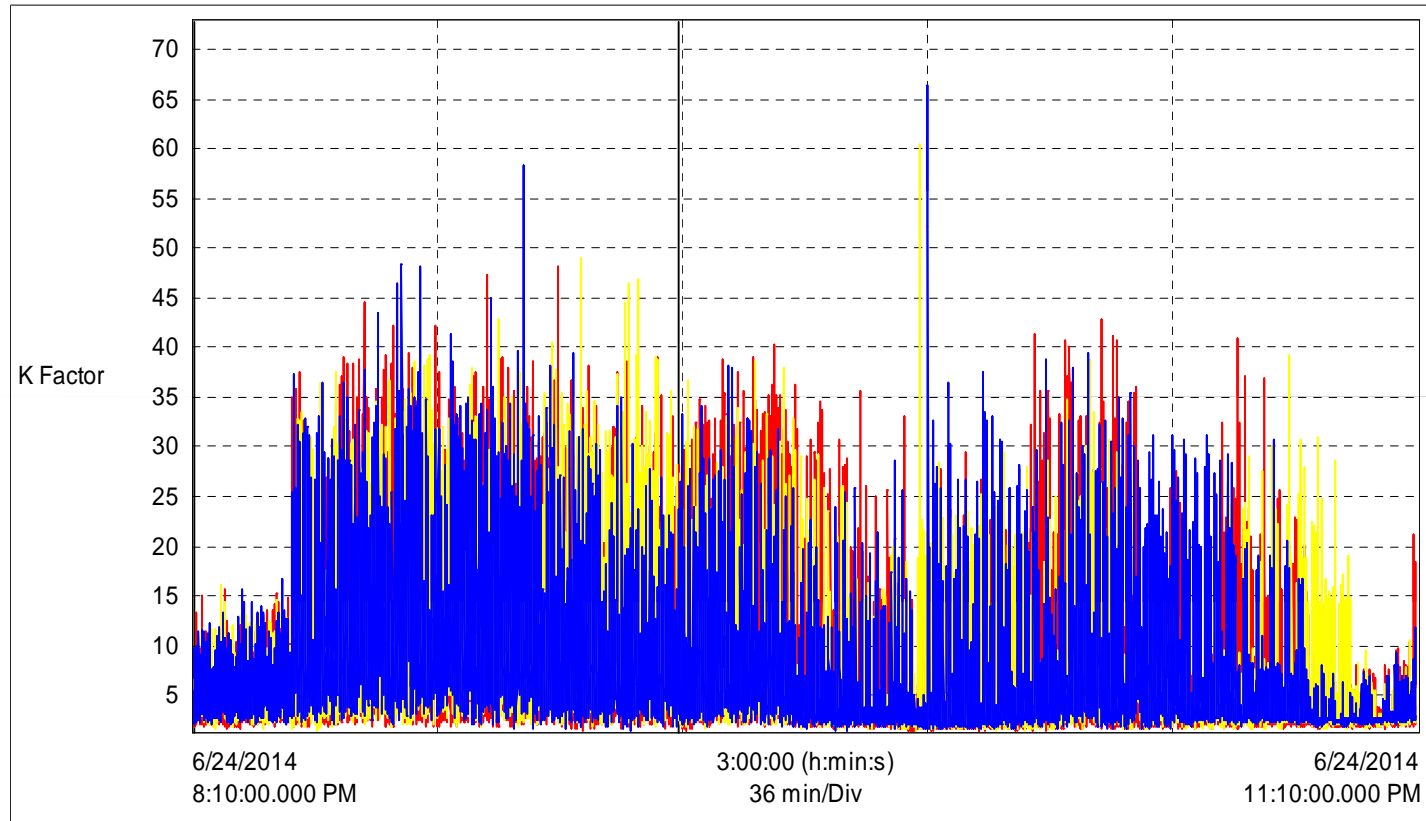
Our observations



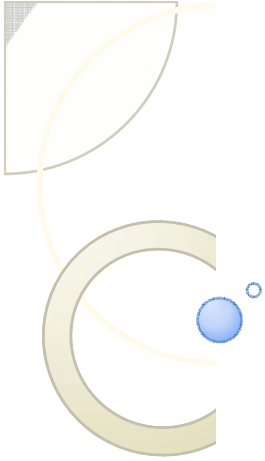
Load current has huge contribution of 3rd, 5th and 7th harmonic currents



Our observations



Load K factor is between 15 to 35%. This calls for transformer de rating by at least 30%.



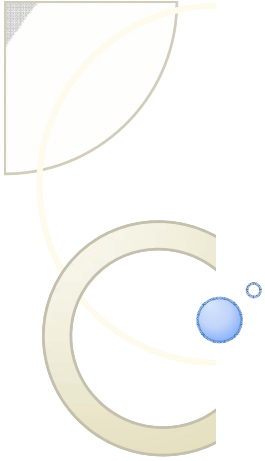
Some Facts

Full load transformer current is 2200 / 2500 Amps and transformer is exposed to 3000Amps frequently. No damage to transformer is observed as this happens with a low duty cycle.

Transformer current contains large amount of harmonic currents

Major reason for these current harmonics is distorted voltage and associated resonance.

At present power factor is corrected by Delta connected capacitors which offer same correction in all phases. The correction is manual and fixed KVAR are connected for dynamically changing requirement.



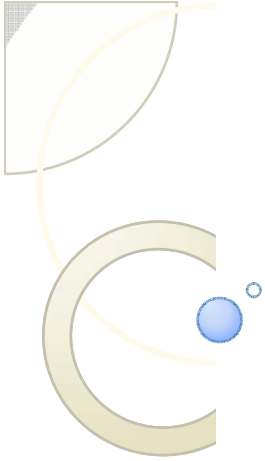
Problems – Present & Future

All though average monthly power factor at HT PCC is on leading side, MSEDCL current harmonic compliance limits are exceeded.

Abnormally high voltage harmonics on entire LT supply may / would cause problems in proper functioning of drives and automation electronics.

This power quality is slow poisoning for other normal loads like water pumps / blowers / Fans etc.

Current harmonics causing abnormally high distribution loss in network.



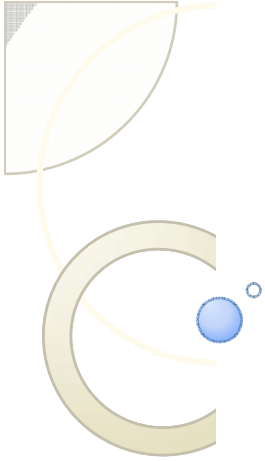
Recommended Solution

All such electrical circuits form complex networks involving different L - C - R impedances of loads, cables, transformers etc.

Ideally such circuits are analyzed using high end simulation software (Like E-Tap / PS-CAD) etc to verify the effect of planned solutions.

In this case simulation is not possible, as load is quite dynamic in nature and can not be modelled easily.

We recommend following practical steps with assured gain in each step.



Recommended Solution

1) Detuned + Dynamic reactive power compensation

To arrest resonance, filter 5th and 7th harmonic current to some extent, correct power factor using exact KVAR values for each phase on cycle to cycle basis by Installing 0 – 1000KVAR step less correction.

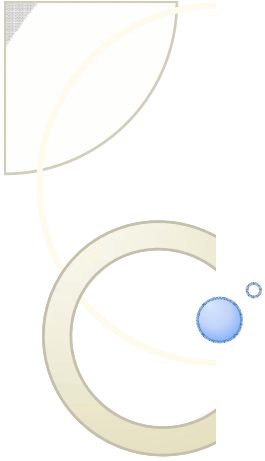
2) Check Current and Voltage harmonic distortion.

If voltage harmonic distortion is not reduced below 5%, check with transformer manufacture, reduce load on transformer, add K factor rated transformer and check above values again.

3) Check following

- 1) power factor for close to unity,
- 2) Current distortion to be 8 to 10%
- 3) voltage distortion to be 3 to 4%

If still current distortion is found to be beyond above values, appropriate Active harmonic filter may be added.



Advantages of step by step approach

- 1) Minimum investment in electronic compensation.
Saving recurring cost in maintenance
- 2) Minimum dependence on proprietary products like active harmonic filters, assets which offer non tangible benefits.
- 3) Each step with assured and required results.
- 4) System with more robust parts like detuned passive filters, transformers, which have more life and more user replaceable parts. – No AMCs.
- 5) Optimum solution.

Recommended Scheme for reactive power compensation

