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Shri Karve - business development director, MGE UPS Systems discusses.....

Impact of Blade Servers on Data Centres

Over a span of five to six years, most servers have moved to dual-corded power input design. This change came about to improve Data Centre resilience, that is, to improve the Nines of availability, in case one cord failed. However, now that each cord is lightly loaded, transmitting only 50 per cent of the power, it is causing problems with leading load power factor. Along with this movement towards dual-carded power input, a number of major UPS manufacturers started to provide suitable load transfer switches (STS) using fast switching Thyristor technology. This enabled critical network loads to have six Nines availability by use of STSs to the dual-corded servers/IT equipment. The two sources feeding the STS can by kept in synchronisation to reduce the source transfer time as seen by critical loads.

At the same time, the Switched Mode Power Supply (SMPS) designs for servers have been modified to meet the demands of various international harmonic control standards, eg, EN/IEC 61000-3-2 and IEEE519. Furthermore, the power supply for critical loads had to also comply with the International Technology Industry Council (ITIC) revised voltage performance curve, superseding the old CBEMA curve.

However, some of the solutions used to meet the EN standards and ITIC curve do not really suit dual-corded or four-corded lightly loaded power supplies. Due to the partial loading of SMPS, the internal filter capacitor becomes dominant and hence presents itself as a leading power factor to the UPS system, which has been designed for 0.8 lagging Power Factor (Cos Phi), supporting the networks.

The Rise of The Blade Server

During the past two to three years, there has been a steady trend for IT environments to attempt to improve their processing power and to reduce occupied space by installing more and more Blade servers. Commonly, in data centres today, there will be a fair mix between the traditional and the new Blade servers. However, leading Power Factor growth and its demand on UPS systems and other supporting units such as standby gen-sets, should be closely monitored for possible exposure to over-loading.

Most of the traditional UPS' have to be de-rated by a factor of 30 per cent to support a Blade server load of 0.9 leading power factor. However, specialist major UPS manufacturers have already launched Blade server-friendly UPS units that do not require de-rating. Equally, the associated gen-sets will need to be de-rated by 40 per cent of their rated power, resulting in higher capacity gen-sets requirement or Active Harmonic Conditioners (SineWave) having to be installed to cope with the leading PF load. Typical issues created by Blade servers include:

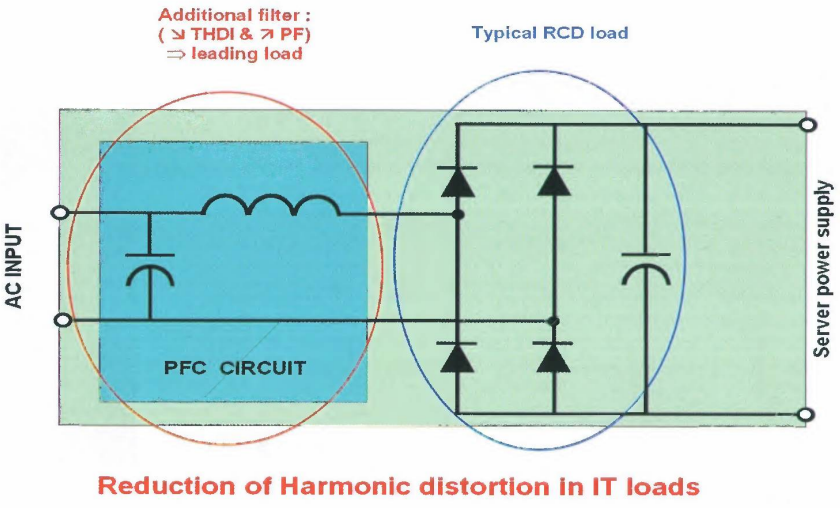
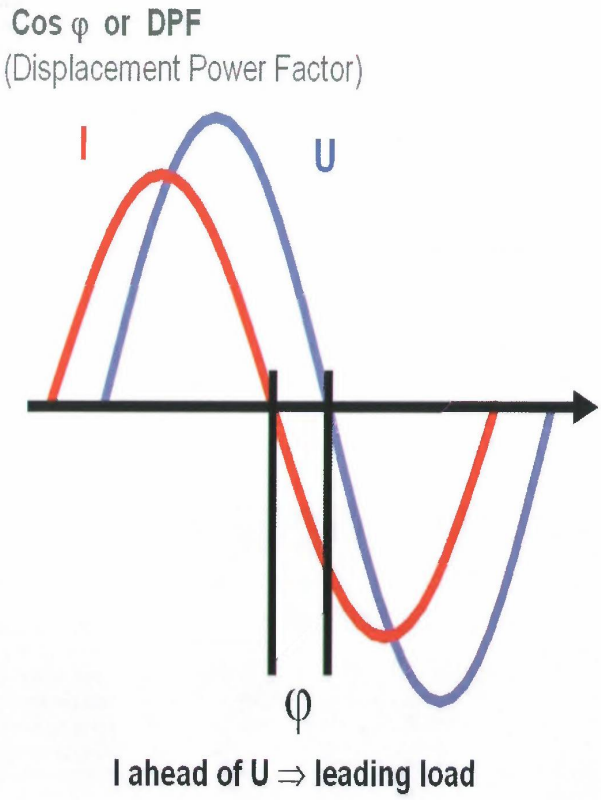


Fig. 1 - Added filter to SMPS

Fig. 2 - Display Leading Load Curve



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- Leading power factor of 0.91
- High inrush current
- High heat density (3-to-4kW) from one Blade Centre

It must be mentioned that harmonic current distortion (THDI) presented by Blade servers has reduced to a very reasonable level of about 18-to-20 per cent. This is a major improvement when compared to the old traditional servers with a THDI of 80-to-90 per cent, and hence the Displacement Power Factor (DPF) and True Power Factors (TPF) are close to each other.

Displacement Power Factor (DPF) takes account of 50Hz components only and hence does not provide any information related to any harmonics within the load, whereas True Power Factor (TPF) measures all the harmonics component and the 50Hz fundamental. In view of this, correct solutions must be sought to ensure that the installed UPS capacity can meet the growing Blade server base within a data centre. This can be resolved by use of Active Harmonic Conditioners such as SineWave which correct leading PF to lagging PF and meet new demand for kVARS, by installing an inductor bank on the output of the UPS, or by creating a better mix of old servers with the new ones. Another solution is to add extra UPS modules to the installed base so that the de-rating and redundancy factors are counter-balanced.

If choosing the inductor bank solution it is essential to be aware of the inrush and switching transient currents imposed on UPSs, an extra burden during load switching corresponding to inductor switching which is not good for the load being supported because it can create spikes.

It is also important to note that, apart from the UPS', the gen-sets supporting them must be considered. They must have adequate capacity to support the leading Power Factor load as a cover for the worst case scenario when the UPS system goes on bypass due to some malfunction during a utility loss. Most gen-sets are not designed to support leading Power Factor type loads and therefore need very close assessment.

However, if there is a shortage of kVARs available from the gen-set to support the Blade server load, then either a bigger gen-set can be installed or, alternatively, an Active Harmonic Conditioner such as SineWave to provide the required kVARs for the load when the UPS goes into unplanned bypass mode.

When designing a new data centre, it is good practice to ensure that adequate steps are taken during selection and sizing of various critical components, for example, UPS and gen-sets, so that there is no exposure to leading Power Factor. In addition, installing new liquid cooled racks is essential to eliminated the extra heat burden produced by Blade servers which could only otherwise be resolved by increasing premium data centre floor space and extra heat.

It is very important that the IT team, the FM engineers within the data centre, and the UPS and other equipment suppliers work together to create a total solution to prevent data centre melt-down. If this communication doesn't take place, there is a major disaster waiting to happen without a warning.

WIP

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E1223

PF CORRECTION Example For GENSET Compatibility

No SINEWAVE	I 1	I 2	I 3	In
Current	114 A	101 A	88 A	59 A
THDI	21 %	23 %	16 %	
Phase Angle	22 ° Lead	20 ° Lead	22 °Lead	
Power Factor	0.93 Lead	0.94 Lead	0.93 Lead	
With SINEWAVE 60 Amp unit				
Current	108 A	96 A	87 A	16 A (14A H1)
THDI	4 %	3 %	3 %	
Phase Angle	4° Lag	8° Lag	8° Lag	
Power Factor	1 Lag	0.99 Lag	0.99 Lag	

Fig 3. Power Factor Measurements

Figure 4 - The SineWave Solution