A CASE STUDY

OF

HARMONIC ANALYSIS & MITIGATION

AT

"PUSHPIT STEEL PRIVATE LIMITED, ANDHRA PRADESH"

Date 29.05.15

➢ Abstract:

The scenario as regards Electrical loads, Utility Tariff structures and Electrical Power Quality issues is rapidly changing. A fresh approach is needed to protect the Electrical installation from adverse impact of these changes. Electrical Loads today are increasingly Non Linear in nature and lead to poor Power Quality. Electrical circuits carry currents of undesirable frequencies besides fundamental current of 50Hz or 60Hz. Fundamental current performs the intended work of catering to power needs of the loads whereas currents of frequencies which are multiples of fundamental frequency create various undesirable effects in the Electrical network.

The term "Harmonic Currents" is a popular buzz word in the power quality industry and the layman needs some information to understand the term and realize they can be a serious problem if not treated properly. The treatment and the details of harmonics is better left to the expert with the proper tools and training.

Problems caused by harmonic currents

- Frequent failure of electrical equipment's particularly PF Capacitors.
- Increased Energy Losses.
- Spurious operation of Electrical Protections.
- Erratic operation of Controls.
- Inaccurate operation of Metering Systems.
- Reduced life of Electrical Equipment's.
- Resonance risks at harmonic frequencies in system.

Advantage of Power Factor Improvement:

- Lower the electricity costs
- Increase KVA capacity (Increase the KW used for same KVA)
- Improve voltage regulation
- Reduction of I2R Losses
- Size reduction in cables, transformers and switchgear
- Expansion without additional electrical improvement
- Allows motors to run more efficiently and cooler, improves their life and operation

The benefits generated by Clariant Power System Ltd solutions are

- Direct savings in Energy Consumption.
- Enhancement in life of Electrical Installation.
- Reduced Maintenance Problems.
- Improved efficiency of Electrical System.
- Incentives on improved Power Factor.
- No penalties by utilities on abnormal Harmonic Levels

- **Company Profile:**

Pushpit Steel Private Limited is a Private incorporated on 29 April 1997. It is classified as Non-govt company and is registered at Registrar of Companies, Pondicherry. Its authorized share capital is Rs. 109,800,000 and its paid up capital is Rs. 73,676,200.It is inolved in Manufacture of Basic Iron & Steel.

Pushpit Steel Private Limited's Annual General Meeting (AGM) was last held on 29 September 2016 and as per records from Ministry of Corporate Affairs (MCA), its balance sheet was last filed on 31 March 2016.

- **Issues being faced by Company:**

1. Frequent tripping of VFD's in DRI.
2. Improper functioning and burning of timers used in starters of motors.
3. Spurious tripping of ACB's in plant.
4. All Multi-function meters and Indicators were Mal-functioning in plant due to high harmonics generated by furnace.
5. Humming sound in motors and VFD commutation chokes.
6. Low Power factor.
7. Captive power plant couldn't run in island mode beyond 20% capacity.

- **Observations before applying solution:**

Harmonic analysis was conducted using Fluke make Harmonic Analyzer type 435. The summary sheet is as below.

Client Name :		Pushpit Steel															
Location :		India															
Date :		29/05/2015															
Sr. No.	Location	Volta (KV)	Current (Amp)	Power (KW)	Power Factor	VTHD %	ATHD (%) Tot	3rd	5th	7th	9th	11th	13th	19th	21th	39th	41th
1	Alternator(12MW) output 11KV,with furnace and power plant auxiliary load	11.6	311	5500	0.88 Lag	39.7	11	1.4	0.9	1	0.8	4.1	3.0	5.6	6.2	2.3	4.0
2	Feeder for Furnace from 15MVA 11kv/33kv transformer.	36.1	82.57	4440	0.86 Lag	51.1	15	0.5	0.5	0.4	0.4	4.7	3.2	8.2	9.0	3.2	4.6

- **Observations after applying solution:**

After installation of given solution, harmonic analysis was conducted and the output data sheet is as below.

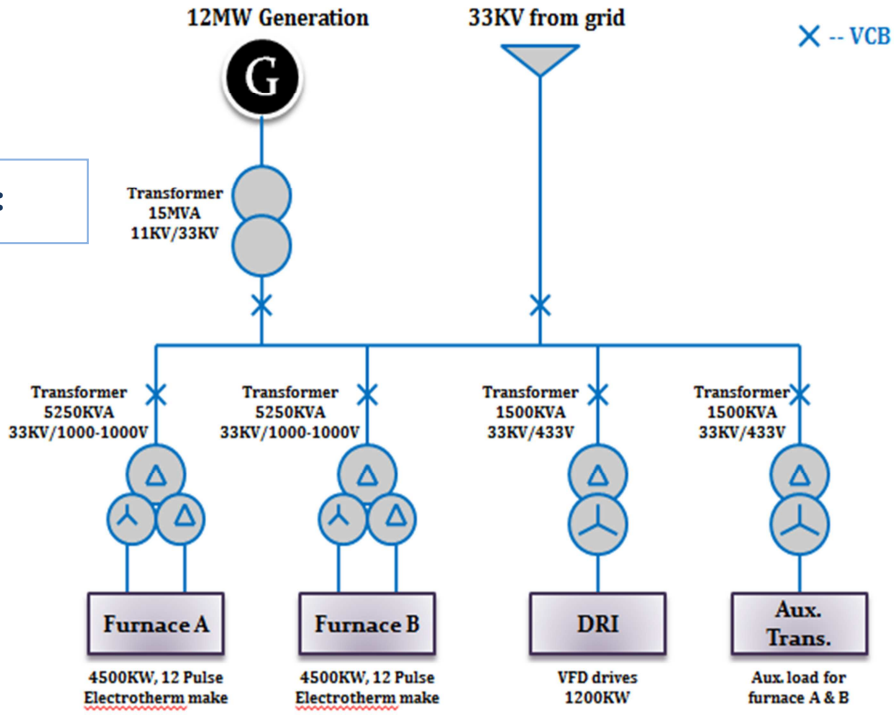
Client Name :		Pushpit Steel															
Location :		India															
Date :		29/05/2015															
Sr. No.	Location	Volta (KV)	Current (Amp)	Power (KW)	Power Factor	VTHD %	ATHD (%) Tot	3rd	5th	7th	9th	11th	13th	19th	21th	39th	41th
1	Alternator(12MW) output 11KV,with furnace and power plant auxiliary load	11.1	288.2	5430	0.98 Lag	13.4	4.9	0.8	0.9	0.6	0.8	2.3	1.8	2.7	2.0	0.9	0.7
2	Feeder for Furnace from 15MVA 11kv/33kv transformer.	32.7	77.3	4335	0.99 Lag	16.1	6.9	0.5	0.5	0.4	0.3	2.9	3.0	4.0	2.7	1.5	2.5

- **<u>Solution Given:</u>**

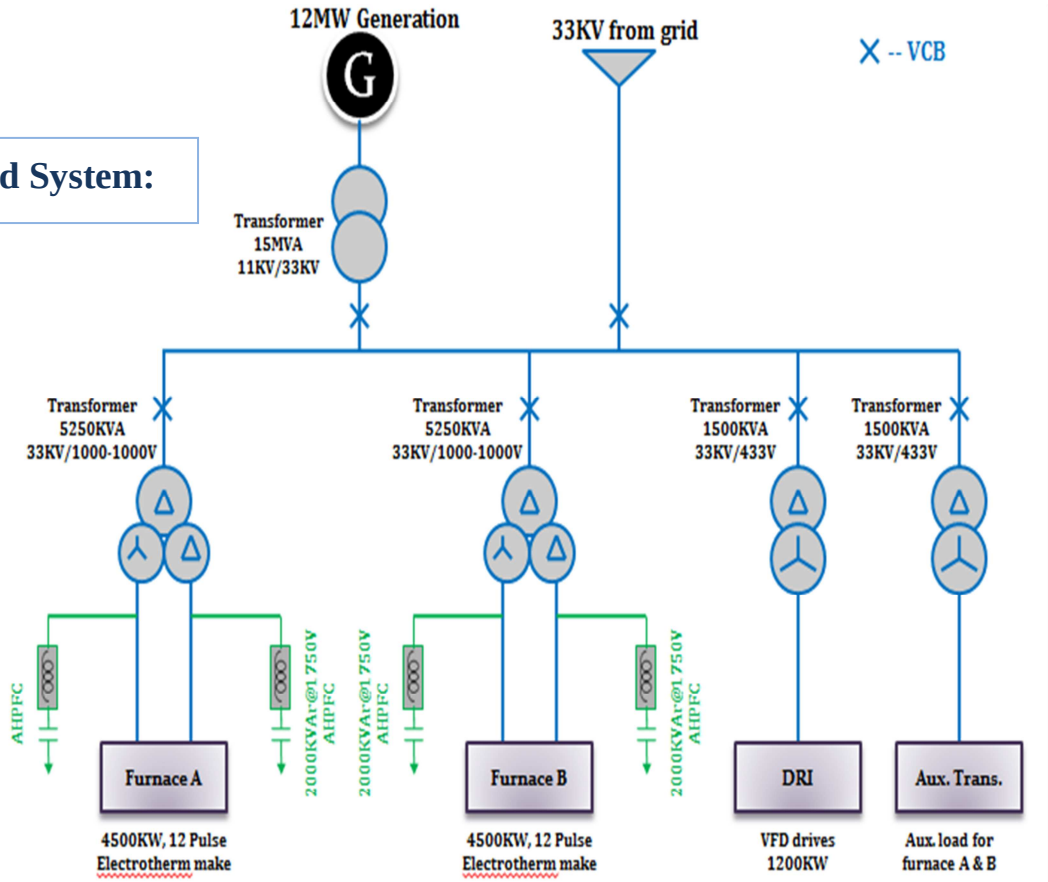
- 2000KVAr x 2 no's 1750V AHPFC panel with specially designed Taped Tuned Reactors & Capacitors @ Furnace A.
- 2000KVAr x 2 no's 1750V AHPFC panel with specially designed Taped Tuned Reactors & Capacitors @ Furnace B.

- **SLD :**

➢ **Existing System :**



➢ **Proposed System:**



- **Customer Survey Results:**

1. After installation & commissioning of 2000KVAr x 4 No's 1750V AHPFC panel @ Furnace A & Furnace B Location, significant reduction of harmonic has been achieved at approx. Unity Power Factor:

- Voltage Harmonics are reduced from 39.7 % to 13.4 %
- Current Harmonics are reduced from 11% to 4.9 % at output of 12MW 11KV Alternator.

2. The Power Factor is improved to 0.998 lag after installation of AHPFC panels.

- **Customer Benefits:**

1. No ACB Tripping, Timer, Card failure from last 6 months.
2. Metering system is working properly & efficiently.
3. Full utilization of 12 MW Alternator
4. Increased life of Machineries by reducing Harmonic current from system.
5. Energy Saving.
6. Reduction in total harmonic distortion being injected in the grid thus avoiding any mal-functioning of harmonic sensitive device.