

In collaboration with Frako-Germany



# A CASE STUDY

### OF

## **HARMONIC ANALYSIS & MITIGATION**

AT

### **"WESTERN METAL INDUSTRIES LIMITED, YAVAT"**

Date 29.05.17

In collaboration with Frako-Germany

CASE STUDY



#### ≻ <u>Abstract:</u>

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.

#### 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

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#### • <u>Company Profile:</u>

**Western Group of Companies** was established in 1960, by a group having rich experience of 30 years in manufacturing of aluminium products. Today **WESTERN** stands tall among all Indian manufacturers of Aluminium Circles, Strips, Sheets and in particular, Aluminium Slugs.

Western Manufacturing plants are located at Hadapsar, Pune and Silvassa, Dadra & Nagar Haveli with latest technique of melting Aluminium with integrated casting and online hot and cold rolling to produce fine quality of final product.

As a producer with rich trade experience they invest money and time to build reliable and long term business relationships & continuously develop quality, service and products range and consider this to be a key moment of their company's global strategy.

All Western products meet the highest quality standard and are well accepted in domestic as well as International market. Western is one of the leading Aluminium Slug Exporters in India.



### • <u>Issues being faced by Company:</u>

- 1. Frequent tripping of grid connected 300KW solar inverter.
- 2. Current and Voltage harmonic distortions found violating IEEE 519 Limits.



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### > Observations before applying solution:

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

Sr. No.	Location	Voltage	Current	Power	Power	VTHD	ATHD (%)						
		(Volts)	(Amp)	(KW)	Factor	%	Total	3rd	5th	7th	9th	11th	13th
1	Secondary Side of Transformer 630KVA, 22KV/433V	419	512	362	0.99 lag	16.5	77.1	10.7	53.2	8.8	8.1	3.5	3.2

#### > Observations after applying solution:

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

Sr. No.	Location	Voltage	Current	Power	Power	VTHD	ATHD (%)						
		(Volts)	(Amp)	( <b>KW</b> )	Factor	%	Total	3rd	5th	7th	9th	11th	13th
1	Secondary Side of Transformer 630KVA, 22KV/433V	416	605	436	0.998 lag	2.5	7.1	3.2	3.9	2.8	0.3	1.1	0.4

### • Solution:

- ➢ 650KVAr, 525V Tuned RTPFC panel.
- > 100Amp Active Harmonic Filter.



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#### Waveform of Voltage Harmonic Distortions



#### Waveform of Current Harmonic Distortions



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### Screen shots taken during measurement:



### • <u>SLD :</u>



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#### • <u>Customer Survey Results:</u>

- 1. After installation, Commissioning of 650KVAr, 525V Tuned RTPFC panel and 100Amp Active Harmonic Filter, significant reduction of harmonic has been achieved at Unity Power Factor:
- Voltage Harmonics are reduced from 16.5% to 2.5%.
- Current Harmonics are reduced from 77.1% to 7.1% at secondary side of 630KVA Transformer.
- 2. The Power Factor is maintained to 0.998 lag after installation of panels.

#### • Customer Benefits:

- 1. Proper utilization of investment on "Solar Power".
- 2. Increased life of Machineries.
- 3. Energy Saving.
- 4. Reduction in total harmonic distortion being injected in the grid thus avoiding any violation of IEEE 519 limits.

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### Clariant Power System Ltd.

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Date: 11.05.2017

#### MOM between Clariant Power System, Pune (India) and Western Metal Industries Limited, Yavat (Maharashtra)

Mr. Vivek Shelke and Mr. Mohsinkhan Ichalkaranje from Clariant Power System Ltd Pune (India) visited Western Metal Industries Yavat plant for commissioning of following Panels

650KVAr, 525V RTPFC Panel – 01 No. (Sr. No. CPSL17/18-005) 100Amp Active Harmonic Filter – 01 No. (Sr. No. CPSI.17/18-007)

- 650KVAr, 525V RTPFC Panel (Sr. No. CPSL17/13-005)
- Location of Panel 630KVA Transformer, Supply Voltage = 3 phase, 433V
- 2. Installation, power and control cable connections are checked and are okay.
- 3. Power Factor is improved to 0.99-1.00 lag after switching ON the panel.
- 2. 100KVAr Active Harmonic Filter (Sr. No. CPSL17/18-007)
- Location of Panel 630KVA Transformer, Supply Voltage = 3 phase, 433V
- 2. Installation, power and control cable connections are checked and are okay.
- 3. Harmonic study was conducted with switching ON both filter panels, Followings are the results,

Condition	Voltage	Current	ĸw	PF	$V_{\text{THD}}$	A <sub>THD</sub>	
Before Installation	419	512	365	0.990 lag	16.5	77.1	
After installation	422	509	362	0.996 lag	1.8	7.1	

- After installation of above harmonic filter panels, the voltage and current harmonics are within the limits specified in IEEE-519 standards. Detailed report will be submitted within 2 to 3 days.
- All filtering system supplied by CPSL were checked thoroughly before and after they were commissioned and no abnormalities were found, all tuned filters are working satisfactorily and delivering good results.
- 6. CPSL strongly recommends to maintain Emergency spares for longer trouble free operation.
- 7. MISHEGEOM ... will call CPSL during MSEB visit for harmonic measurement.

For Western Metal Industried

Mr. Mihir Shah

HI Yaday

For Clariant Power, Pune

Mr. Mohsinkhan Ichalkaranje

Mr. Wvek Shelke