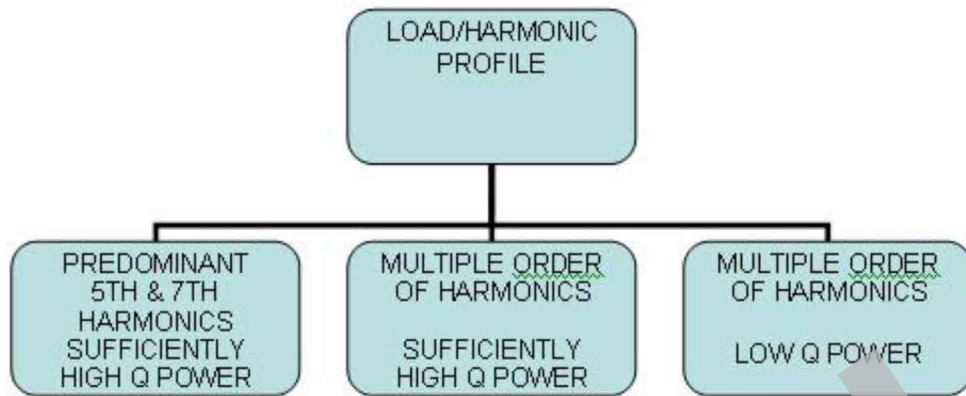


# HARMONIC FILTER SYSTEMS - INDUSTRIES - HARMONIC PROFILE



## SCHEME

### Load Centric Filter System:

1. The Harmonic Filter Systems are distributed in the Load Centres
2. Suppress the level of harmonics at the point of generation
3. Balance harmonic / reactive power compensation at the PMCC level.
4. Maximizes the savings
5. Ensure the PMCC level of harmonics always under control in the event of break-down of any particular system.

### Group Control Filter System:

- The Harmonic Filter Systems are connected to PMCC
- Suppress the voltage harmonics to lower value as per IEEE Norms
- Usually Passive Filter System are selected based on the "Q" Power.

## IMPACT OF HARMONICS ON CAPTIVE POWER PLANT LOADING

### - TUNED PASSIVE HARMONIC FILTER SYSTEMS

#### POLYESTER FILM PLANT

##### PREAMBLE

The plant has Polyester Film Production process. To have reliable and continuous production process, the Power Supply is by Captive Genset. Problem was reported on the captive genset performance, which could not be loaded to its maximum level and was experiencing rotor jerking & rotor retardation causing over temperature tripping. Hence Power Quality study was conducted at site to improve the Loading on 4.2 MW Wartsila Captive Genset and to reduce the Fuel Consumption.

## SITE ANALYSIS AND OBSERVATIONS

An extensive Power Quality Analysis was done at site and the following are the observations.

### Temperature Rise of the Synchronous Alternator is due to the following :

- Fundamental Current including Active Current and Reactive Current.
- Reverse Harmonic Current flow in the Windings.
- Increased Winding Resistance for Harmonic Frequencies.
- Rotor Jerking operations due to current harmonics in the Alternator winding.
- Rotor retardation in the alternator due to voltage harmonics.

All these individual components increase the heat in the winding, thereby increasing the Temperature.

## Harmonic Amplification :

Amplification of current harmonics is noticed due to the usage of unchoked fixed capacitors.

Amplification of Current Harmonics will also lead to increase in Voltage Harmonics.

## Harmonics :

Voltage harmonics is prevalent throughout the distribution network and the same is due to the current harmonics and the alternator design.

Since, optimum design of alternator is followed, further reduction in the voltage harmonics is possible only by reduction of current harmonics, thus improving the distribution network.

## INFERENCE

The root cause of the problem is due to higher level of 5th harmonics : Captive Genset could not be loaded to its maximum efficient level and Rotor jerking & Rotor retardation causing over temperature tripping.

## SYSTEM DESIGN AND RECOMMENDATION

Basic necessity of the system is identified as:

1. 5th Harmonic Suppression.
2. Reactive Power Compensation.

To achieve the above stated objective, BARON-ASHF Harmonic Filter System is installed at the following Feeders, where the level of harmonics is higher:

Feeder Reference	System
Extruder Motor	BARON-ASHF/200
DC Drive	BARON-ASHF/100
Film Plant – 1	BARON-ASHF/100
Film Plant – 2	BARON-ASHF/150

## PERFORMANCE WITH BARON-ASHF SYSTEMS

Parameters	Without BARON-ASHF System	With BARON-ASHF System
<b>Electrical Parameters</b>		
Voltage Harmonics at 11 KV side	5.5%	1.46%
Loading on Genset	3.4 MW	4.1 MW
<b>Savings :</b>		
KWh Units per Litre of Furnace Oil	4.09 units per litre	4.17 units per litre
Savings	---	Approx. Rs.1.50 Crores p.a
<b>Indirect Benefit</b>		
		Avoidance of Over Temperature

## SAMPLE PERFORMANCE WITH LOAD CENTRIC BARON-ASHF/200 SYSTEM

Parameters	Estimated Saving	Actual Saving
<b>Electrical Parameters :</b>		
KWHR Reduction	41916 units	45619 units
KVA Reduction	174 units	166 units
Current Reduction with Filter	222 Amps	240 Amps
Voltage Stabilising with Filter	3 Volts	10 Volts
5th Current Harmonics Reduction with Filter (in Magnitude)	115 Amps	166 Amps
<b>Savings</b>		
Total Savings in Rupees	Rs.5,44,476/- per annum	Rs.5,41,037/- p.a

## **BENEFITS**

Due to the implementation of the Passive Harmonic Filter Systems at the points of generation, and the said problem of Overtemperature Tripping was avoided and the loading on the Genset was improved thereby reducing the cost of per unit generation.