

THYSSENKRUPP

Application of filters for 5th and 7th harmonics on 800 VAC

Background:



Even when the application of absorption filters for harmonic currents is well known and experienced by Arteche in low-voltage systems (240V and 480V), on this occasion the challenge was to adjust the standard filter design for their fitting at voltage of 800 Vac. The application took place on the company premises of *Thyssenkrupp*

Metalúrgica de México S.A. de C.V., devoted to manufacture of rods for motors and located in the township of San Miguel Xoxtla very near the city of Puebla.

Among the most important processes carried out in this plant are the casting and treatment of steel for which induction furnaces are operated which use electrical energy through different sub-stations of the plant at 800 Vac. These furnaces are operated by six-pulse rectifier circuits and are coupled electrically to double-secondary transformers, supplied by a general bus of 6200 V, originating from the plant's main sub-station and provided at 115 kV, 3 Phases, 60 Hz, by a C.F.E. power-line.

The plant previously operated with a monthly electrical power requirement of 6MW and PF of 0.83, thus requiring correction of the PF in a secure manner, for prevention of the penalizations received from C.F.E. and reducing the plant's present outgoing harmonic currents.

Development:

Arteche carried out an electrical assessment of the plant's power system in order to determine the necessary specifications and features for performing the task in a secure and reliable manner. Technical and financial suggestions were submitted for which the company decided to invest in harmonics filters with two stages: the first for prevention of low-PF penalties and the second, once the results were known, toward obtaining the PF-related bonus from C.F.E. and also considering the energy savings attained.

In February of 2005 the first stage of the project was carried out, in which two absorption filters for harmonic filters were installed, with the specifications 800 kVAR, 800 V, each in the secondary sections of the transformer supplying the plant's 3000 FURNACE. The following diagram shows the electrical lay-out of the harmonics filter location.

Sub-station (area)	kVAR installed	Tension (Volts)	Demand kW
HORNO 3000*	800 (2)	780	377

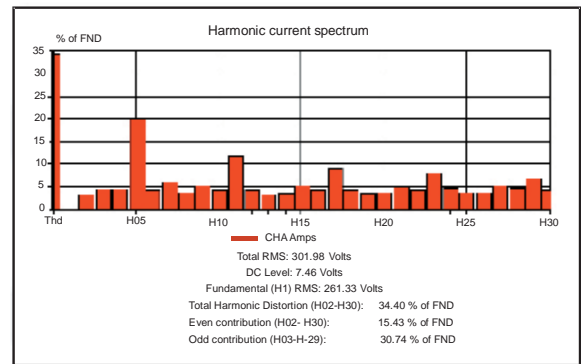
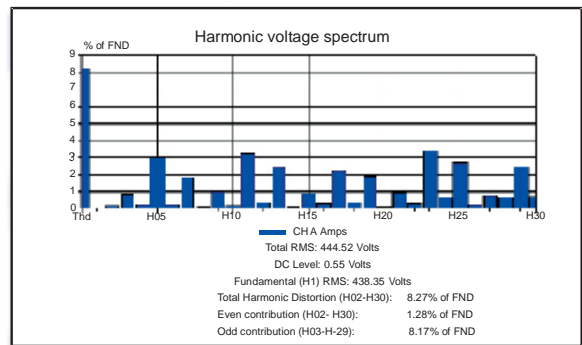
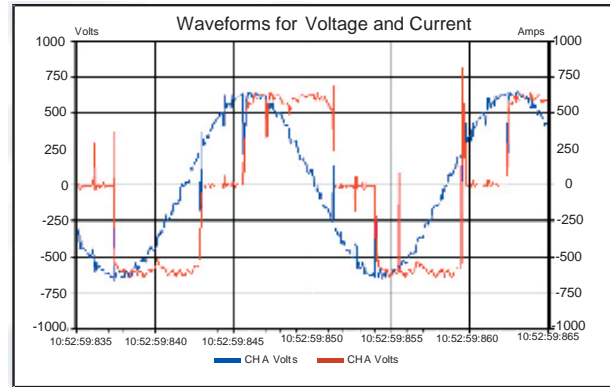
Total Current (Amps)		THD (V) %	
With filter	W/o filter	With filter	W/o filter
310	500	4.98	8.27

THD (I) %		Power Factor	
With filter	W/o filter	With filter	W/o filter
19.78	38.4	1.00	0.68

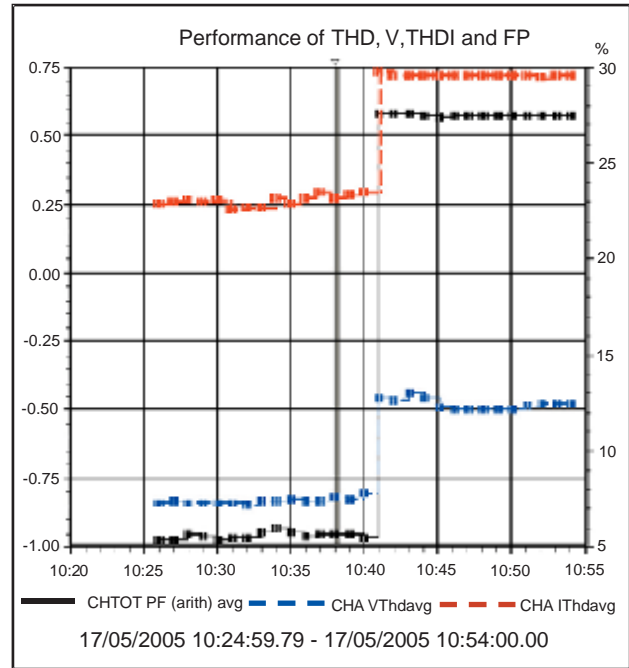
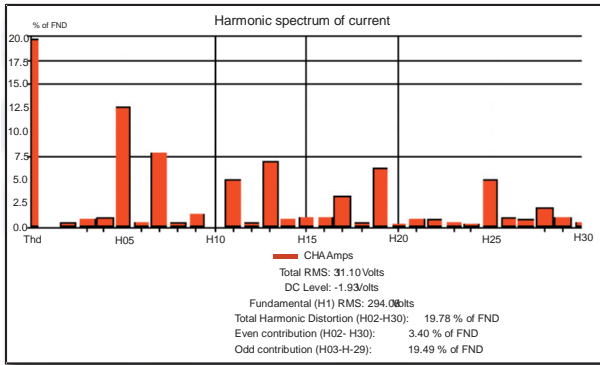
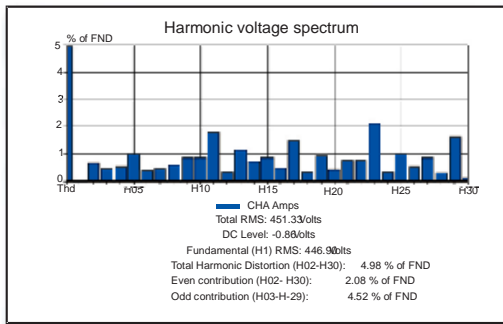
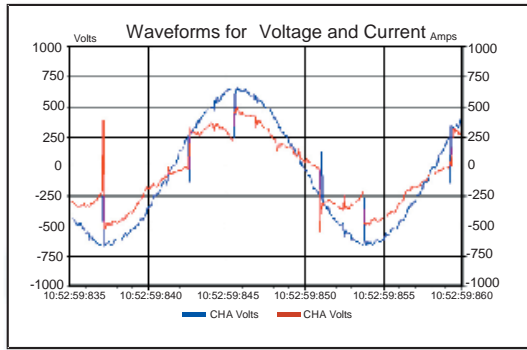
With the above, the plant is no longer paying penalizations relating to PF and with the savings achieved it is estimated that the investment in equipment will be redeemed in 9.5 months.

The following charts show the waveforms and harmonic spectrums for the result of the application of filters in the plant's power system.

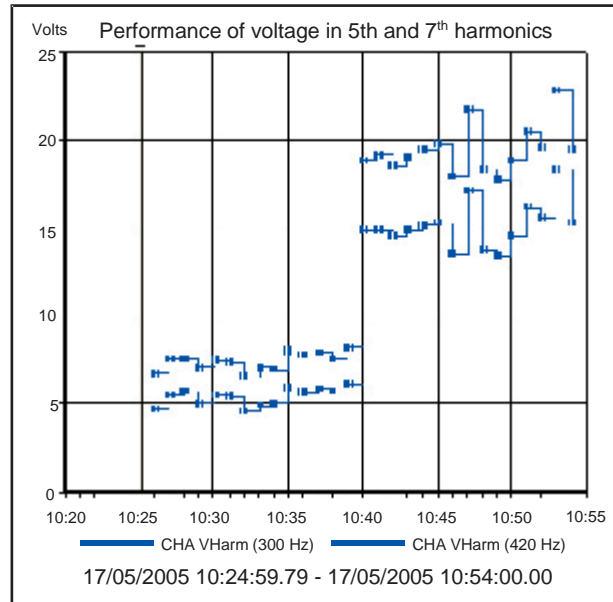
Measurements without filter



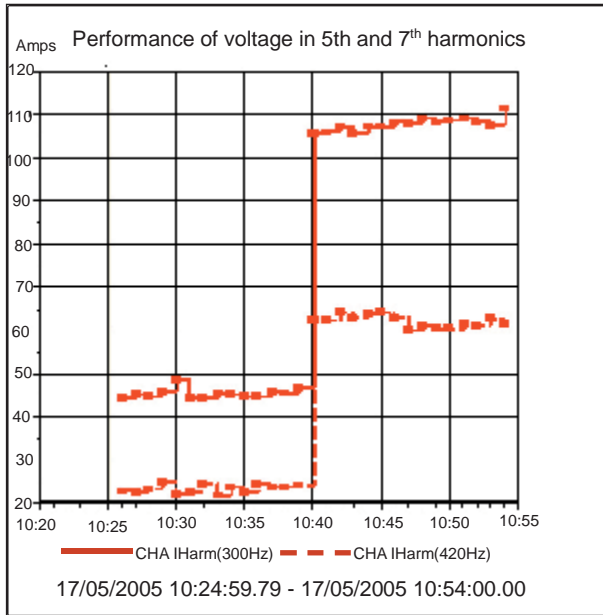
Measurements with filter



	Avg
CHTOT PF (arit) avg	-0.25
CHA VThdavg	9.74
CHA IThdavg	26.11



	Avg
CHA VHarm (300Hz)	13.44
CHA VHarm (420Hz)	10.29



	Avg
CHA IHarm (300Hz)	76.66
CHA IHarm (420Hz)	42.91