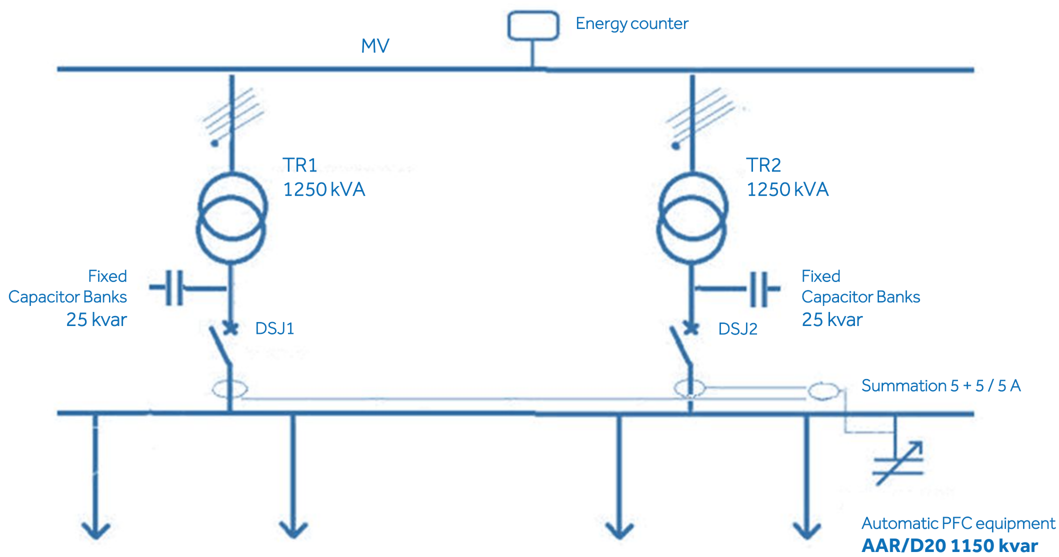
PFC of a wire drawing manufacturer (case study)

In this specific case we'd like to show how we solved the compensation of a big manufacturing company producing copper and aluminium wires. The electrical installation is composed of two transformers 1250kVA / each, steady connected in parallel and a power centre cabinet for the supply of all the loads. The main loads are protected by MCCB. Loads are mainly big motors driven by frequency converters for old and new generation drawing machines and other machines needed to manufacture copper and aluminium cables.

The goal was to compensate the reactive energy of the whole installation with a single PFC equipment, in order to gain a **cosφ greater than 0.95** at the level of the electrical counter in Medium Voltage side.

To meet this ambitious objective, above all, it was necessary to compensate the two transformers without loads. In order to be sure that all loads are well compensated (considering that it is almost impossible that the power from the two transformers is equilibrated), we have installed two CTs, one downstream of each main MCCB and a summation CT of 5 + 5 / 5A.

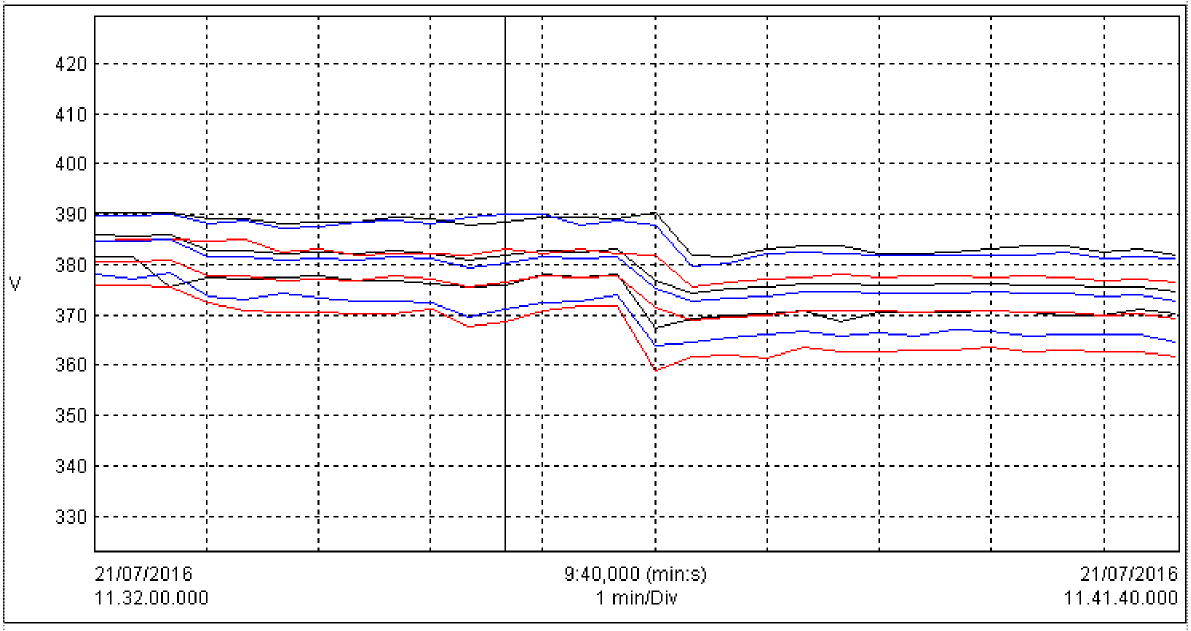
Here below the electrical scheme of the installation:



The two 1250 KVA transformers have a 2% no-load magnetic current, consequently we chose to compensate the no-load reactive power with 25kVAr fixed capacitors bank.

Below, the main results of the measurement campaign performed before PFC installation:

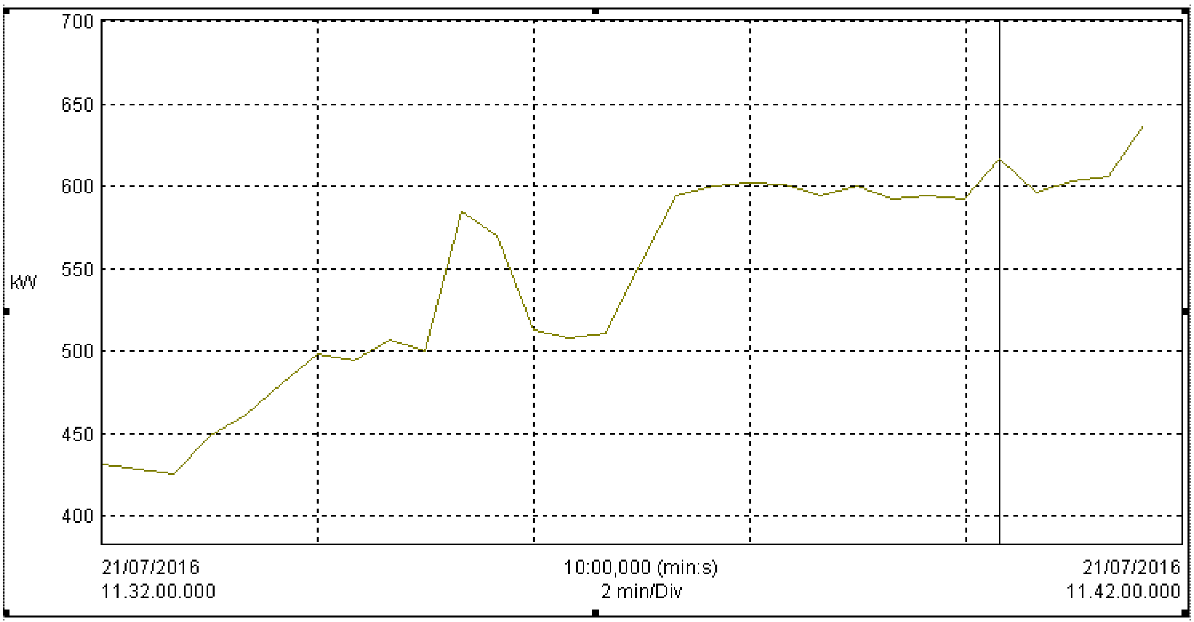
Voltage between Phases



Name	Date	Time	AVG	MIN	MAX	Unit	Duration	Unit
U12 rms	21/07/16	11.32.00.000	379,429	367,400	390,400	V	10:00,000	(min : sec)
U23 rms	21/07/16	11.32.00.000	374,124	358,800	385,100	V	10:00,000	(min : sec)
U31 rms	21/07/16	11.32.00.000	377,938	363,900	390,200	V	10:00,000	(min : sec)

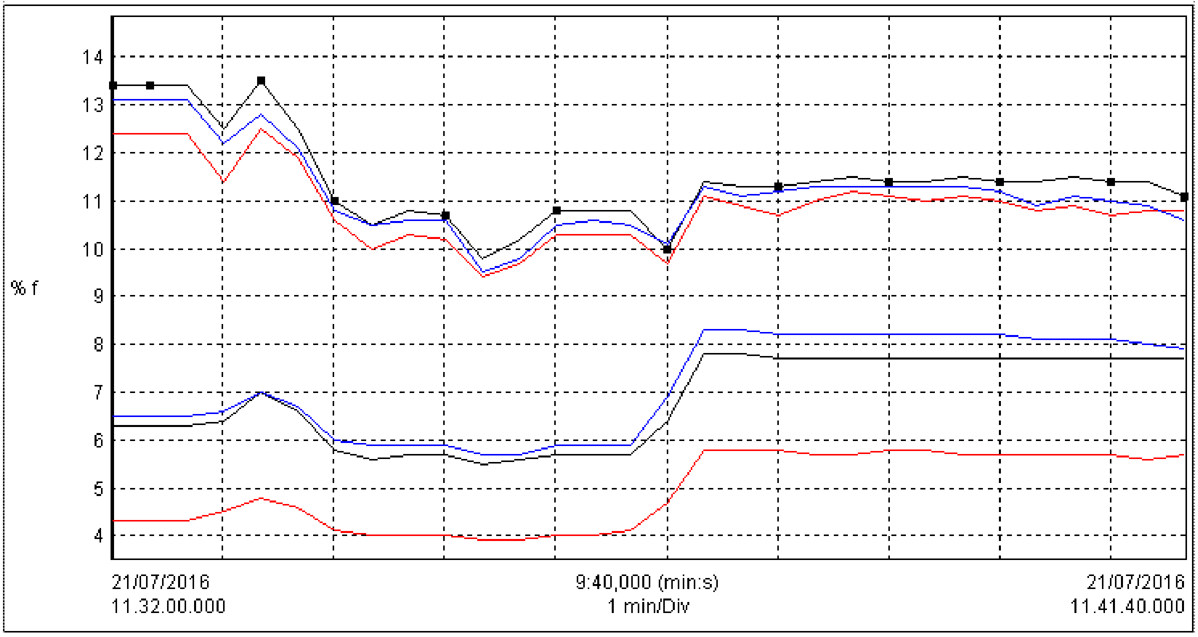
As you can see, when the production machines are activated, the voltage drops, due to a strong current demand. This fact is even more evident if we simultaneously analyze the graph below, of the variation in the total power required.

Change in total Active Power



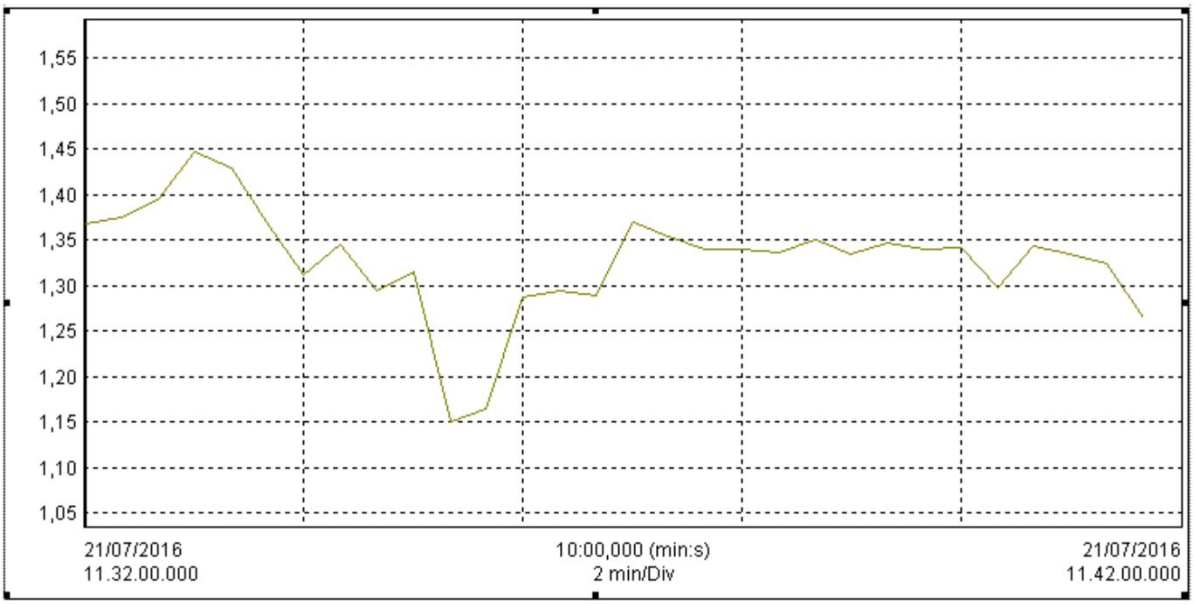
Name	Date	Time	AVG	MIN	MAX	Unit	Duration	Unit
PT (W)	21/07/16	11.32.00.000	544,976	425,528	637,237	kW	10:00,000	(min : sec)

THD% in voltage and current



Name	Date	Time	AVG	MIN	MAX	Unit	Duration	Unit
A1 THDf	21/07/16	11.32.00.000	11,450	9,800	13,500	% f	10:00,000	(min : sec)
A2 THDf	21/07/16	11.32.00.000	10,897	9,400	12,500	% f	10:00,000	(min : sec)
A3 THDf	21/07/16	11.32.00.000	11,190	9,500	13,100	% f	10:00,000	(min : sec)
V1 THDf	21/07/16	11.32.00.000	6,810	5,500	7,800	% f	10:00,000	(min : sec)
V2 THDf	21/07/16	11.32.00.000	4,923	3,900	5,800	% f	10:00,000	(min : sec)
V3 THDf	21/07/16	11.32.00.000	7,123	5,700	8,300	% f	10:00,000	(min : sec)

Change in Tg φ



Name	Date	Time	AVG	MIN	MAX	Unit	Duration	Unit
Tan φT	21/07/16	11.32.00.000	1,329	1,150	1,448		10:00,000	(min : sec)

Considering this achieved data and a future extension of the plant for a new production line we recommended the installation of an automatic capacitor bank with Reinforced block reactors, type **AAR / D20** (capable of supporting an Harmonic Distortion in Voltage **THDVmax = 20%**) with a power of **1150 kvar.**

This capacitor bank is composed of the following steps: 2x25 + 50 + 4x75 + 5x150 kVAr, managed by the new generation regulator **HPR12**, with twelve output relays.
The controller was set to reach a **cosφ of 0.98 (Tgφ = 0.2)**.

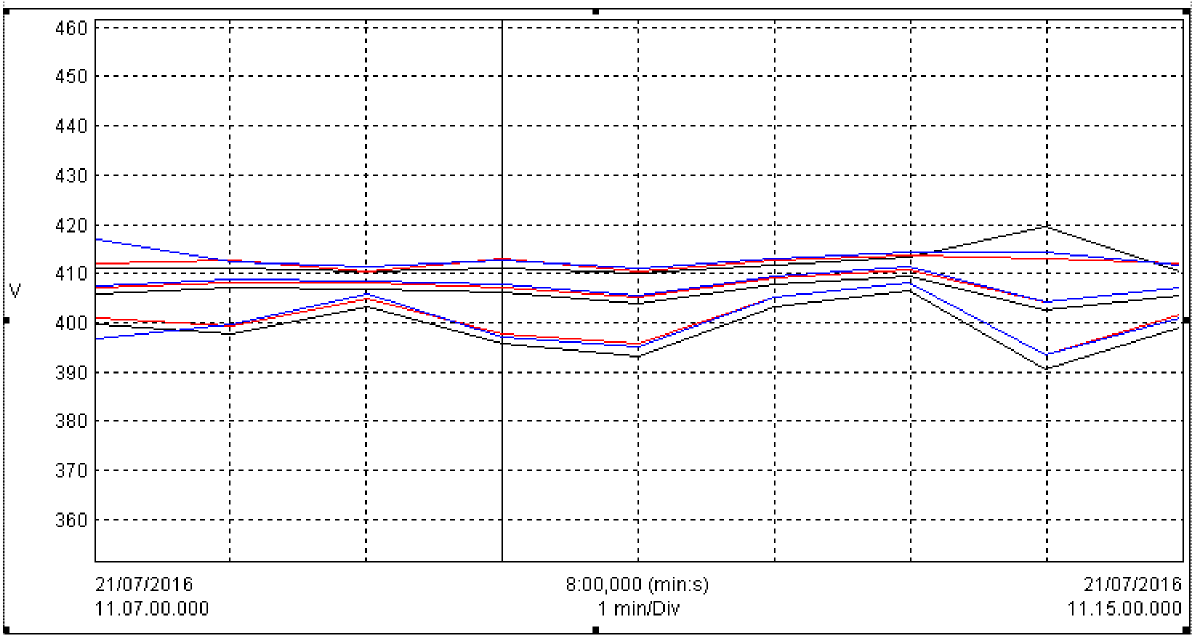
To reach the aim of compensating at this high cos**φ**, the cabinet was designed with two steps of 25kVAr (the 2% of the total power).

Photos of AAR / D20 1150 kvar installed

In this way we obtained a very good results in compliance with the customer's requested specification. Furthermore the transformers are no longer overloaded, and they supply only the active current (the reactive current is residual) and the testimony of this fact is that the average voltage stabilized around 407V.

The series AAR / D20 capacitor banks is designed for particularly polluted networks such as cables manufactures, foundries, metal working like cold rolling, swaging, extrusion, coil bar and tube drawing.

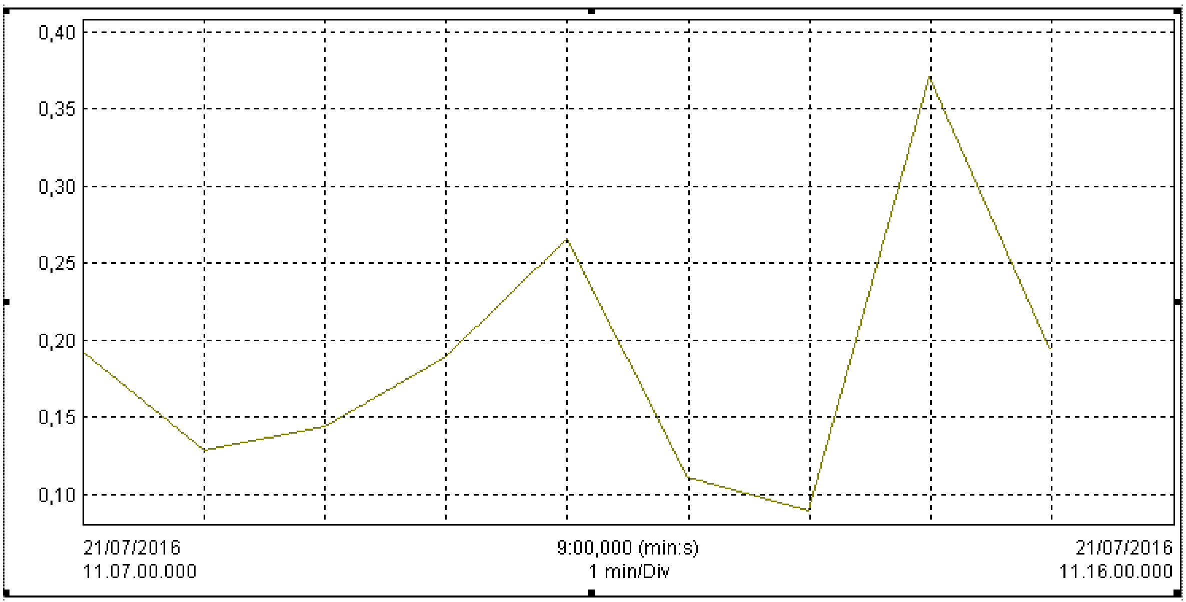
Voltage between Phases



Name	Date	Time	AVG	MIN	MAX	Unit	Duration	Unit
U12 rms	21/07/16	11.07.00.000	406,171	390,500	419,600	V	9:00,000	(min : sec)
U23 rms	21/07/16	11.07.00.000	407,437	393,600	413,800	V	9:00,000	(min : sec)
U31 rms	21/07/16	11.07.00.000	407,827	393,400	416,800	V	9:00,000	(min : sec)

Below the graph of the Tgφ showing as the AAR/D20 PFC reacts to the variation of the power of the load.

Change in Tg φ



Name	Date	Time	AVG	MIN	MAX	Unit	Duration	Unit
Tan φT	21/07/16	11.07.00.000	0,187	0,089	0,371		9:00,000	(min : sec)