

# Power Quality problems in the mould industry

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## 1. Interest of work

The evolution of the worldwide economy led to an increasing competitiveness, and some factors that were considered irrelevant in the past are now of most importance today. With the decrease of the profit margins, any incident disturbing production may imply huge losses, sometimes difficult to regain.

The constant modernization of manufacturing processes is based on the widespread of electronic equipment. These electronic equipments have an increased sensitiveness to power quality (PQ) disturbances and, at the same time are responsible for PQ degradation. One example of the use of advanced manufacturing processes is the mould industry. Most of the work is based on CNC (computer numerical control) machines and other sensitive equipments.

Some disturbances in a CNC machine can lead to the loss of materials, damage in the tools and some hours or even days of lost work. Along with these direct costs, some indirect costs, such as the inability to satisfy the delivery dates to the client may compromise the company's competitiveness.

A cluster of this industry is based in the centre of Portugal, mainly in the Marinha Grande-Leiria area, which comprises some hundreds of small and medium companies and a several hundred million euros business.

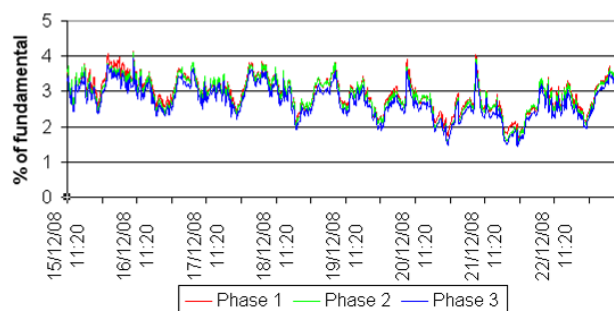
## 2. Objectives and methodology

This work intends to depict the most critical PQ disturbances suffered by the mould industry and the related problems felt by this sector.

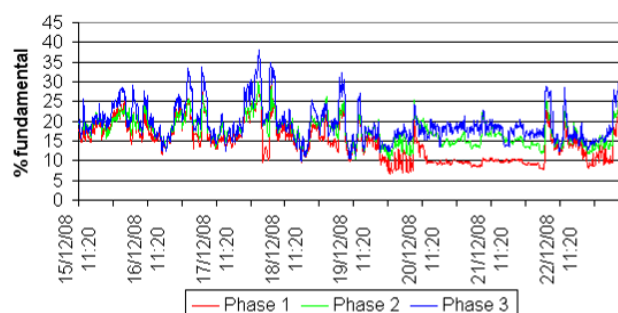
This work is based on data gathered from monitoring campaigns and from Quality of Service reports issued by the operators of the transmission and distribution (T&D) networks.

### A. Monitoring

The monitoring campaigns were carried out using two equipments (Hioki Power Quality Analyser 3196). The equipments monitored 3-phase voltages and currents at the main switchboard and/or the feeders of the most critical machines of the manufacturing process.



**Fig. 1** – Voltage harmonic distortion at the main switchboard of a mould industry unit.



**Fig. 2** – Current harmonic distortion at the main switchboard of a mould industry unit.

**Table III** – RMS voltage events (aggregated) during a monitoring campaign at a mould industry unit in 8 days (15 to 23 December 2008).

Voltage (% of $U_{ref}$ )	Number of events / Duration (seconds)							
	[10m; 100m]	[100m; 500m]	[500m; 1]	[1; 3]	[3; 20]	[20; 60]	[60; 180]	[180; $\infty$ ]
[180; $\infty$ ]	0	0	0	0	0	0	0	0
[160; 180]	0	0	0	0	0	0	0	0
[140; 160]	0	0	0	0	0	0	0	0
[120; 140]	0	0	0	0	0	0	0	0
[110; 120]	0	0	0	0	0	0	0	0
[70; 90]	5	5	0	0	0	0	0	0
[40; 70]	2	0	0	0	0	0	0	0
[10; 40]	0	0	0	0	0	0	0	0
[1; 10]	0	0	0	0	0	0	0	0
[0; 1]	0	0	0	0	0	0	0	0

The most relevant data will be presented, such as voltage and current harmonic distortion in Fig. 1 and Fig. 2, and RMS event detection in Table 1.

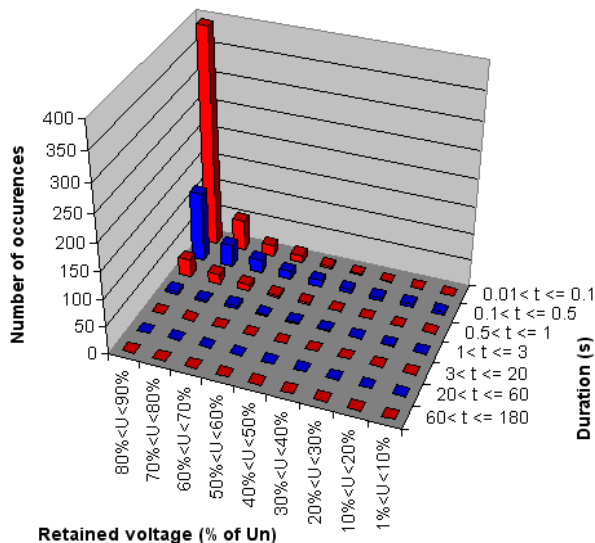
The results will be commented on mainly according to the Portuguese regulation instruments (NP EN 50160 and RQS<sup>1</sup>). The consequences of these values and events will be discussed.

### B. Data from T&D networks

Some data gathered from the Portuguese T&D networks operators is presented. Data from the distribution network is presented in Fig. 2 and data from the transmission network is presented in Fig. 3. Finally some recommendations to minimize the influence of PQ events in this sector are suggested.

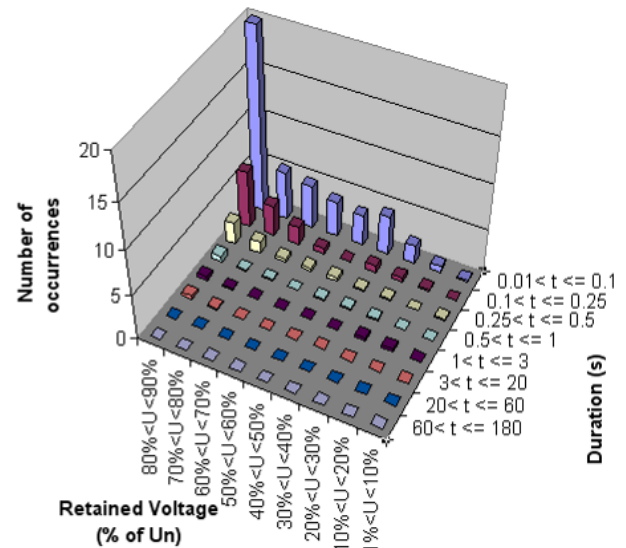
## 3. Main contributions

With this work it is intended to describe PQ events at one key industrial sector in the centre of Portugal, mould industry, and its major consequences.



**Fig. 3** – Annual average voltage dips registered at several 30 kV bus in electrical substations, registered in 2007.

A contribution to a clearer understanding by the industry of the PQ issues, its causes and consequences is expected. They must acknowledge that, as a player in the electricity market, they must be actively involved, taking action in order to minimize the costs of PQ disturbances. This may be crucial to increase the competitiveness of this sector.



**Fig. 4** – Annual average voltage sag, and its classification, registered at interconnection points (seven sites) between transmission and distribution networks, during 2007.

## References

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<sup>1</sup> RQS (Regulamento da Qualidade de Serviço) is the Portuguese Quality of Service Code for the electric sector and NP EN 50 160 is the Portuguese version of the European Norm 50 160:1999.