

# High frequency harmonic reduction and resonance suppression on dredging vessel

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**Abstract** – This document describes the problem statement and solution because of damage to electronic components in the installation due to supraharmonic problems on a dredging vessel. Measurements were done by Karybel, the solution was provided by Benelux Power Quality Partner.

**Index Terms** – Power Quality, supra harmonics, resonance

## I. INTRODUCTION

Dredging vessels are equipped with several pumps. These pumps are or frequency controlled or driven by direct online motors. In the latter, these motors are equipped with soft starters because of high starting currents. These electronic components are introduced in an environment with high frequency distortions causing resonance and damage to these components. During measurements it was seen that the main dredge pump has a major influence on the power quality on board. If this pump is operational and soft starter driven direct online motors are started up, the risk of damage to these soft starters is high.

## II. THE PROBLEM

Capacities spread around the power grid, e.g. long cable sections, input filters of inverters or compensation systems without choke, are forming together with the power supply transformer a resonance. If a source for a current is existing within the power grid close to this frequency, already a minor current can result in high disturbances of the voltage levels. In practice, several soft starters showed damage comparable to overvoltage effects.

## III. MEASUREMENTS WITHOUT FILTER

Measurements without filter show that there is a high level of notching on the voltage. These notches contain high frequencies beyond the measurement capabilities of standard power quality devices. For this purpose, measurements were done with a Vecto III Power Quality Analyzer allowing to measure up to 25 kHz. These measurements were combined with scope measurements for the higher frequencies.

Measurements are performed on the power grid in different situations with and without different loads. The voltage distortion in Fig. 1 is measured with the main dredge pump running.

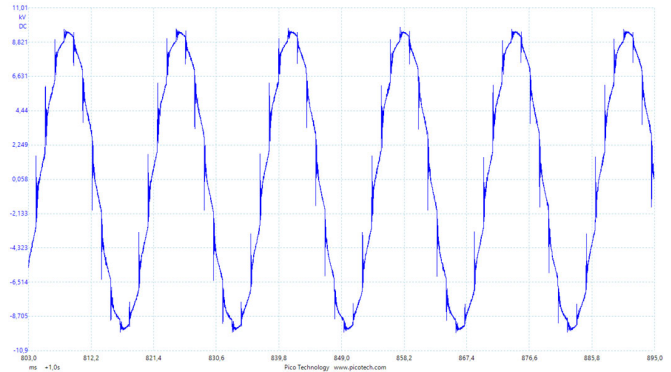


Fig. 1: voltage waveform without filter

The frequency contents of this signal show elevated levels of higher harmonic voltages at 12 kHz.

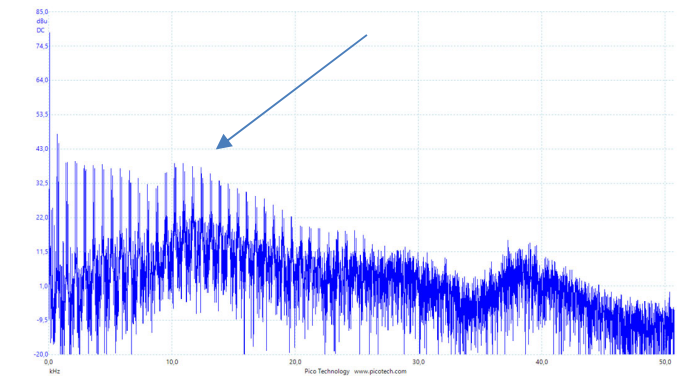


Fig. 2: voltage harmonic spectrum without filter

## IV. THE SOLUTION

In order to suppress these harmonic voltages and prevent resonances to occur a Resonance Elimination System was installed. Using a usual LC absorption circuit, network resonances cannot be eliminated completely but only be shifted to another frequency. By the introduction of damping – e.g. a high pass resistor – resonances can be completely eliminated from the perspective of electrical systems.



Fig. 3: RESI resonance elimination filter for 6,6 kV

## V. MEASUREMENTS WITH FILTER

After installation, measurements were re-executed. The voltage waveform shows high suppression of notches in the voltage and reduction of higher frequencies.

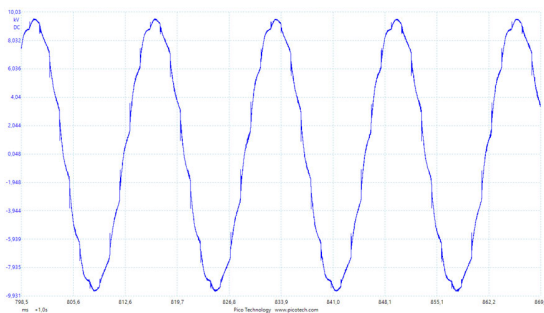


Fig. 4: voltage waveform with RESI filter

With a filter installed, the voltage levels of the higher frequencies are reduced with some 20 dBu and consequently reducing the risk of resonances in the installation.

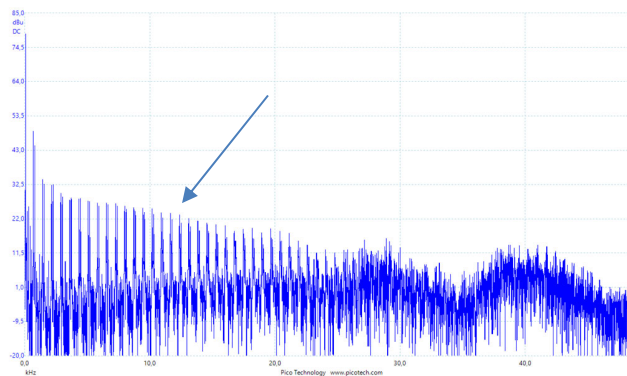


Fig. 2: voltage harmonic spectrum with RESI filter

## VI. CONCLUSION

Before installation of a resonance suppression system, the client suffered of high distortion levels on the voltage, leading

to damage on power electronic devices. The installation of the RESI filter suppresses the high frequencies and prevents resonances to occur.

A combination of standard power quality analysis and supraharmonic measurements lead to the dimensioning of the most optimal solution for this problem.

## VII. ABOUT

### A. Karybel

Karybel is the electrical expert who ensures the continuity of your production and working environment. Our extensive analyzes, studies, advice, engineering, implementation and monitoring lead to a well-considered and optimal solution for your electrical problem.

Karybel is specialized in Power quality measurements and engineering studies. It has an important fleet of measurement equipment to suit every need. Karybel is the European distributor of Vecto III power quality devices.

We are the partner in the field of power quality, electrical energy distribution and renewable energy.

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### B. Benelux Power Quality Partner

Benelux Power Quality Partner is a solution provider and offers a solution for the different aspects related to Power Quality. Based on our many years of experience and a team of qualified engineers, we study every enquiry and offer adequate solutions. Together with leading manufacturers, we are able to propose both standard products and tailormade systems for every need.

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## VIII. REFERENCES

- [1] Condensator Dominit GmbH, "Resonance elimination systems," Brilon.