



Services

Power System Quality Analysis

The DP and electrical engineering team at Maritime Assurance & Consulting (MAC) offers third-party verification services on a vast range of marine, offshore and renewable projects.

MAC prides itself on having a great depth of experience through its people, providing tailored solutions to meet the requirements of our clients and the client's insurance provider.

MAC offers services which are independent of any regulatory authority, designer, installer or hardware provider, ensuring no conflicts of interest exist.

Power System Quality and Harmonic Distortion

Devices that have an output waveform different to their supply are referred to as non-linear devices.

When power is supplied to non-linear loads, harmonic voltages are produced that corrupt the supply voltage upstream causing every consumer downstream to receive a distorted voltage.

Non-linear devices typical to a modern vessel include:

- Variable speed drives (VSDs)
- Uninterruptible power supplies (UPSs)
- Fluorescent lighting
- Office equipment
- Galley appliances
- Workshop equipment.

Motivation for Power System Quality Analysis

As the number of non-linear devices increases on modern vessels there is increasing concern for vessel safety and the main classification societies have all stressed the importance of limiting total harmonic distortion to within acceptable limits.

The effects of harmonic distortion are numerous and can be catastrophic in terms of a vessel's ability to maintain position:

- Overheating in generators, transformers, induction motors and fixed speed electric motors can lead to unexpected early life failure
- Electric cables can lose conduction efficiency, overheat and fail
- UPS supplies can experience disruption
- Sensitive electronic devices and their protection can trip spuriously on detection of distorted supply waveforms
- Voltage resonance can lead to over voltage/current failures in the electrical network.

MAC provides a completely independent service from any regulatory authority, designer, installer or hardware provider, ensuring no conflicts of interest exist.



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Power System Quality Analysis

Our Analysis

Methods for detecting distortion on the power system are numerous:

- Power factor and crest factor measurements are simple indicators of waveform purity
- Waveform analysis in the time domain and frequency domain can provide both a qualitative and quantitative analysis of any distortion
- Total Harmonic Distortion (THD) is a useful measurand for power system quality.

Each non-linear load is analysed individually, as well as the impact on the switchboard sections, from LV to HV.

This is conducted in a logical manner, taking into account the various modes of operation and power system loading conditions for the vessel, with a view to isolating the main sources of harmonic distortion.

What you get

As well as a detailed report on the power system quality and problem areas in the system, you will receive third-party, impartial advice on remedial action to minimise harmonic distortion.

Mitigation methods include:

- Line reactors – typically applied to VSDs, smoothing out current harmonics and reducing harmonic voltage distortion
- Specialised transformers – designed with phase shifting properties to cancel certain problem harmonics
- Passive filters – simple LC circuits connected in parallel with the non-linear load to draw the harmonic currents away from the source impedance
- Active filters – power electronics that generate frequency components to cancel parasitic harmonics
- Hybrid filters – use a combination of active and passive filters.

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