

# Harmonic Distortion for Ship Electrical Distribution System including Harmonic Filters

## 1. General

The total harmonic distortion (THD) of electrical distribution systems is not to exceed 8%.

This limit may be exceeded where all installed equipment and systems have been designed for a higher specified limit and this relaxation on limits is to be documented (harmonic distortion calculation report) and made available on board as a reference for the surveyor at each periodical survey.

## 2. Monitoring of harmonic distortion levels for a ship including harmonic filters

2.1 Where the electrical distribution system on board a ship includes harmonic filters, such ships are to be fitted with facilities to continuously monitor the levels of harmonic distortion experienced on the main busbar as well as alerting the crew should the level of harmonic distortion exceed the acceptable limits. Where the engine room is provided with automation systems, this reading should be logged electronically, otherwise it is to be recorded in the engine log book for future inspection by the surveyor. However, harmonic filters installed for single application frequency drives such as pump motors may be excluded from these requirements, i.e. Sections 1 to 4.

2.2 As a minimum, harmonic distortion levels of main busbar on board such existing ships are to be measured annually under seagoing conditions as close to the periodical machinery survey as possible so as to give a clear representation of the condition of the entire plant to the surveyor. Harmonic distortion readings are to be carried out when the greatest amount of distortion is indicated by the measuring equipment. An entry showing which equipment was running and/or filters in service is to be recorded in the log so this can be replicated for the next periodical survey. Harmonic distortion levels are also to be measured following any modification to the ship's electrical distribution system or associated consumers by suitably trained ship's personnel or from a qualified outside source.

Records of all the above measurements are to be made available to the surveyor at each periodical survey.

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### Note:

1. This UR, except for Section 2.2, is to be uniformly implemented by IACS Societies:
  - i. for ships contracted for construction on or after 1 July 2017 or
  - ii. for ships where an application for a periodical or occasional machinery survey after the retrofit of harmonic filters is dated on or after 1 July 2017.
2. Section 2.2 is to be uniformly implemented by IACS Societies for ships contracted for construction before 1 July 2017, at any scheduled Machinery periodical survey having a due date on or after 1 July 2017.
3. The "contracted for construction" date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of "contract for construction", refer to IACS Procedural Requirement (PR) No.29.

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(cont)**3. Mitigation of the effects of harmonic filter failure on a ship's operation**

Where the electrical distribution system on board a ship includes harmonic filters the system integrator of the distribution system is to show, by calculation, the effect of a failure of a harmonic filter on the level of harmonic distortion experienced.

The system integrator of the distribution system is to provide the ship owner with guidance documenting permitted modes of operation of the electrical distribution system while maintaining harmonic distortion levels within acceptable limits during normal operation as well as following the failure of any combination of harmonic filters.

The calculation results and validity of the guidance provided are to be verified by the surveyor during sea trials.

**4. Protection arrangements for harmonic filters**

Arrangements are to be provided to alert the crew in the event of activation of the protection of a harmonic filter circuit.

A harmonic filter should be arranged as a three phase unit with individual protection of each phase. The activation of the protection arrangement in a single phase shall result in automatic disconnection of the complete filter. Additionally, there shall be installed a current unbalance detection system independent of the overcurrent protection alerting the crew in case of current unbalance.

Consideration is to be given to additional protection for the individual capacitor element as e.g. relief valve or overpressure disconnecter in order to protect against damage from rupturing. This consideration should take into account the type of capacitors used.

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