World Sailing

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21 January 2022

ISO TC188 Sent by email to: chair of TC188: Mr Craig Scholten, cscholten@abycinc.org

CC: TC188 Secretariat: Anette Eriksson, anette.eriksson@sis.se

Dear Craig,

Re: ISO 12215 Part 9 and Sailing Yacht Keel Fatigue

Further to our correspondence last Summer. Following the launching of the voting procedure regarding a systematic review of ISO 12215-9:2012, World Sailing supports a recommended action by the voting members to revise/amend the standard by:

- Examining the Total Damage Ratio "MSF" value in ISO 12215-9
- Establish if the current fatigue recommendations should be part of the mandatory requirements for ISO 12215-9

World Sailing has recently received a joint expert report regarding a 2020 keel failure on a two-year-old keel. The primary cause of the keel's failure was metal and weld fatigue.

World Sailing, through its Offshore Special Regulations Structural Plan Review Scheme has established a process to review and certify monohull construction standards. For category A monohulls of less than 24m length of hull, the review is carried out by World Sailing appointed EU authorised notified bodies. The aim is to ensure that these yachts comply with World Sailing Offshore Special Regulations 3.03 - Hull Construction Standards (Scantlings) and are eligible to compete in races.

A considerable number of yachts that are raced are simply series production craft that have been assessed using the criteria laid down in harmonised ISO standards that provide a presumption of conformity with the requirements of the Recreational Craft Directive (RCD). As you are aware conformity assessment ensures that the requirements of the RCD relating to a product have been fulfilled, conformity assessment does not assess the standards themselves. It is therefore essential that the ISO standards for structure, as the basis for World Sailing's Structural Plan Review[1], are suitable for series production yachts so they can be used safely.

One specific part of ISO 12215 that is used in the Structural Plan Review Scheme is Part 9 – Sailing craft appendages. In 2019 World Sailing's Oceanic & Offshore and Special Regulations committees established a working party[2] to investigate the reasons for continued failure of series production and custom sailing yacht keels and the requirements within ISO12215 Part 9, particularly those related to the fatigue recommendations within the standard.

[1] ISO 12215 Part 5; Part 8 and Part 9: where applicable to design category A ("ocean") - Sailing Craft

[2] The Working Party includes representatives including Chairman of World Sailing Committees, National Sailing Authorities, Classification Societies, Sailing Class representatives.

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It is notable that the Part 9 states" The operational life of the craft is assumed to be 8 million stress cycles. This is based on an assumed operational envelope various times on different points of sail, average tacking 2 times for beating, average rolling periods for downwind, typical wave encounter periods, estimated heel angles and is only intended to be representative. This corresponds to about 25–30 years of moderate-to-high usage recreational sailing or about five years of very extensive ocean racing (one, 30 000 NM, competition plus associated training and preparation annually). This is 15 % of the figure of the number of cycles normally used in ship fatigue assessment."

Our background investigation has established the following statistics and observations:

- In relation to the World Sailing OSR structural plan review, circa 60% of keels certified are hollow welded structures and around 5% are canting keels.
- Welding design in sailing yachts seems to be frequently performed by novices or composite engineers and often rely on manufacturer's standards showing lack of understanding of structural importance.
- The fatigue methodologies in ISO 12215-9 has produced an awareness, but it is too slow. Designers need to have knowledge and capabilities through a process of "education".
- Fatigue Design is essential for metal keels and provisions already exist for proper design.
- Production can be a "common" marine standard if instructions given on design drawings are appropriate.
- The awareness of importance of a proper weld design, even today, is often poor.
- The awareness of high strength steel properties and behaviour today is poor.
- High profiled projects with correct design are often not subject to failure.
- A reduction of 25% stress range would extend the fatigue life by a factor of 2.
- 25% better FAT class (quality) extends the life by a factor of 2.

World Sailing kindly requests that ISO12215 Part 9 is opened for revision in respect of these criteria to examine and verify the validity of the keel fatigue requirement for series production yachts with a view to making these recommendations a requirement under the standard.

Yours sincerely

Simon Forbes

Offshore and Technical Manager

Jason Smithwick – Chairman of World Sailing Keel Fatigue Working Party, RORC Rating Office Technical Director