Measurement of Daggerboards for Nacra 17

Preamble

As a class we are sprinting to put in place a measurement system ahead of the 2019 European Championship. Checks were done in Miami and Palma. In the best case scenario, immediately following the Genoa regatta measurement kits will be made available so that all sailors can prepare their board to fit into the new tolerances ahead of the 2019 Euros. We may not be able to accomplish each part necessary in time, in which case we will aim to do the same ahead of Tokyo 2019 Test Event.

Overview

With the March 2019 rule changes, the process for repainting and the sanding necessary to do was updated within the class rules. Because the surface of the carbon can be prepared for repainting, while the shape of the board can not be altered, it is necessary for the daggerboards to also be measured of part of class controls.

In Miami and Palma 2019, two iterations of that testing have been conducted and this report has been prepared for class members to review before implementation.

Process

5 templates have been produced to check the profile and thickness at 5 stations along the daggerboards. These profiles let us check the shape of both sides of the boards, as well as the thickness. Additionally, we can measure the thickness of the trailing edge. After optimisations from Miami, the templates in Palma worked well enough for us to be comfortable to establish tolerances which class members should adhere to in future racing.

One more set of modest adjustments will be made to the templates before another round of checks in Genoa occurs. If the templates pass the check in Genoa, we will implement enforcement to the tolerances for the Europeans in May 2019.

Measurement Pack

The aim of enforcing tolerances is not to catch teams prior to major championships. The aim of checks is to verify that teams are sailing with boards that fit within the norms the class is comfortable with.

As such, the plan is to reproduce measurement packs so teams can ensure their foils fit the tolerances at all times, and especially heading into championships or games. Teams will get the same tooling that the IM's get, and instructions on how to do the checks. That way, all teams should come through measurement with their boards verified to fit the class norms.

IM's will also have intermediary templates available, to ensure that teams do not optimise just for the measurement stations.

The packs will include

- 5 templates
- A rope to establish the 5 stations
- Suitable shape deviation thickness gauges
- Thickness deviation gauges
- A Grease marker
- Optionally, a digital caliper

Establishing Class Tolerances

20 data points will be taken at standard measurement per board. At each of the 5 stations the following will be checked.

1. Outer shape deviation
2. Inner shape deviation
3. Thickness deviation
4. Trailing Edge Thickness

The attached table is the raw data taken from Palma, when nobody has been able to prepare for such checks.

The shape deviation is to the hundreds of a mm. Most shape deviation was either nil, 0.15mm or 0.2mm. Some boards had between 0.25mm or 0.31mm, and just a couple had greater deviation that that.

The thickness deviation full range, from thinnest to thickest, was 2mm, with most boards having between 0 to 1 mm thickness deviation from the tooling.

The trailing edge thickness was measured with a caliper, with most measurements falling between 1.7-2.0mm, and some deviation greater or less than this range.

There has been some discussion about fancier scanning systems that could do a more thorough job. While is it true that we could adopt a technology heavy approach, the beauty of this approach is that teams can each have their own measurement kits, and without high cost or technical knowledge can prepare their foils and everyone else can see it and understand it as well.

Initial Class Tolerances

We propose that the initial class tolerances be:

- 0.25mm maximum deviation from shape on daggerboards
- 0 - 1mm range in thickness from the closed tooling
- 1.6 to 2.1 mm for trailing edge thickness, with a square edge

It would be possible to give broader or tighter tolerances, and over time, the class might choose to adjust this standard through class rule change processes.

Appendix A – Summary of overall statistics

Overall, the data shows acceptable variation. Considering few teams would have been able to prepare their boards intentionally to fit tightly to the mean, the overall range of boards is quite acceptable. If we

are to supply the means for teams to know where they sit, we should expect the vast majority of boards to be able to fit within class tolerances.

There is one cause for concern. There were only 3 brand new boards measured, and at stations 2 and 4 the data was almost lying in outlier range. We should not want work to be done on new boards, and therefore, we should recommend that stations 2 and 4 be slightly updated and then rechecked in Genoa to see if the tooling can better reflect the initial current state of the build. Of course, if the tooling is altered, then the rest of the fleet would need to be rechecked to ensure that hasn't created a gap in the majority of boards.

The new board deviation is highlighted in yellow.

			Outside Deviation				Inside Deviation				Gap to Jig		
			Station 1	Station 2	Station 3	Station 4	Station 1	Station 2	Station 3	Station 4	Station 1	Station 2	Station 3
Average			0.154	0.103	0.137	0.084	0.114	0.144	0.091	0.053	0.676	0.469	0.333
Average Repainted			0.151	0.114	0.126	0.104	0.108	0.165	0.064	0.067	0.640	0.393	0.214
Average Original			0.149	0.095	0.140	0.072	0.112	0.129	0.099	0.036	0.672	0.500	0.344
Average Brand New			0.243	0.100	0.183	0.050	0.150	0.133	0.133	0.133	0.833	0.333	0.667
Deviation Evaluation													
St Dv Orig + Repainted	Outside	0.109											
St Dv Orig + Repainted	Insite	0.108											
Average stations 2-4	Outside (2-4)	0.122											
St Dv Orig + Repainted	Inside and Ou	0.111											
Thickness Evaluation													
Average		0.486											
Standard Deviation		0.487											

Here is the trailing Edge Data

Trailing Edge Thickness	(mm)	
Number of Data Points	124	
Average	1.83	
Standard Deviation	0.21	
1 St Dv Range (66%)	1.62	2.04
2 St Dv Range (95%)	1.40	2.26

Appendix B – Raw Measurement Data from Palma

Attached in PDF