NATIONAL HANDICAP FOR CRUISERS (NHC)

Results Software Calculations 2014

The following is intended to give club handicap officers and sailing secretaries alike an overview of the calculations that the approved softwares use in order to score NHC races and calculate the handicap number to be used in the next race. This document can also be used by software developers that wish to add an NHC plugin to their programme (if you are a developer looking to implement an NHC plugin you are strongly encouraged to contact the RYA Technical & Racing Services Department technical@rya.org.uk). As of April 2014 the RYA approved software for NHC are HALs Race results and SailWave.

Updates for 2014

In NHCs first year, the RYA Technical and Racing Services Department received a vast variety of feedback from clubs and race organisers regarding NHC club and regatta with suggested improvements based on observations from their racing. These were received by the RYA and used to formulate this year's scoring programme plugins as detailed below. The main changes include:

- The removal of "regatta" mode.

- The introduction of highlighting extreme performance to reduce the knock on effect to the rest of the fleet.

- The prevention of any handicap jumping up or down adversely due to extreme performance.

- The realignment of all competing boats handicaps after each race to allow for new boats to enter a series and compete fairly.

Calculating race results

The approved softwares will calculate results for any race as follows:

C = E x NHC#

Where;

C = The corrected time to the nearest second (used to score a race).

E = The elapsed time to the nearest second (where a boat finished/ took part in a race and has an elapsed time)

NHC# = The handicap number used in that race expressed as a Time Correction Factor (TCF)

An example is shown in the table below.

Boat Name	Elapsed Time (E)	NHC Handicap number	Corrected time	Position	Points
Boat 4	3448	0.964	3324	1	1
Boat 3	3548	0.939	3332	2	2
Boat 1	3527	0.966	3407	3	3
Boat 2	4610	0.819	3776	4	4
Boat 5	0	0.983	0	DNC	6

[NB unless specified, the Racing Rules Appendix A is applied for other scoring issues such as DNC, Times may be in either seconds (as above) or in hh:mm:ss. In the above example, although boat 1 finishes before boat 3 on the water, its corrected time is more so is scored lower in the result set.]

Adjusting handicaps

The adjustment calculations for NHC use known principles. For every race that a boat competes in, an achieved handicap is calculated. This achieved handicap is the handicap that if re-scored, all boats would score equal 1st. A percentage of this achieved handicap is then applied to a boats current handicap to give the handicap to be used for the next race. If a boat has not taken part in a specific race it will receive no adjustment and it will carry forward its current handicap to the next race.

The achieved handicap for each boat in a race is calculated as follows:
The sum of the Handicaps used by all the boats that took part in the race divided by the sum of the adjustment scales from boats that took part in the race, multiplied by the individual adjustment scales of boats that took part in the race.

The adjustment scale for each boat is calculated as 100 divided by the elapsed time.
Expressed mathematically as:

$$TCFr = (\Sigma TCF / \Sigma AS) \times AS$$

Where:

TCFr = Achieved handicap.

TCF = Handicap used.

AS = Adjustment scale (100/E).

E = Elapsed Time.

After the TCFr for each boat in a race is calculated a comparison is made and analysed to highlight any boat that may have over or under achieved their handicap by a larger than usual margin. Reasons for such could be missing a tidal gate, ripping a spinnaker or picking a shift no one else spotted etc. This is calculated by first dividing each boats achieved handicap by their used handicap to display performance as a percentage. These handicaps are then analysed using standard deviation to highlight any individual boat(s) that may have experienced an "extreme" performance. If a boats percentage performance is more than 1.5 standard deviations or less than 1 standard deviation from the mean percentage performance it is highlighted as an extreme performer for the sake of handicap adjustment.

This is expressed mathematically as:

$$TCFr / TCF = com\%$$

Where:

com% = Percentage comparison of the achieved handicap.

IF com% > 1.5σ + x = Ex OR IF com% < x - 1σ = Ex

Where:

1.5σ = 1.5 standard deviations from the mean percentage comparison.

1σ = 1 standard deviations from the mean percentage comparison.

x = the mean percentage comparison from all boats that competed within the race.

Ex = the boat being analysed is highlighted as an extreme performer.

For any boats that are highlighted as extreme performers, their handicap to be used in the next race is calculated based on the performance of all boats that took part in the race. This is calculated by taking a percentage of the used handicap and achieved handicap to give the next race handicap. The percentage levels vary dependant on if the boat over or under achieved in the race. If the boat over achieved and is highlighted as an extreme performer its next handicap will be 85% of the used handicap and 15% of the achieved handicap. If the boat, under achieved and is highlighted as an extreme performer its next handicap will be 92.5% of the used handicap and 7.5% of the achieved handicap.

This is expressed mathematically as:

TCFnex = (TCF x 0.85) + (TCFr x 0.15) [for over performance]

TCFnex = (TCF x 0.0.925) + (TCFr x 0.075) [for under performance]

Where:

TCFnex = An extreme performers next race handicap.

For all other boats that are not highlighted as extreme performers, the same process is carried out in the absence of the extreme performers. I.e. A new set of adjustment scales are calculated and a new set of achieved handicaps are created. This is best shown mathematically as follows:

TCFr2 = (ΣTCF/ΣAS2) x AS2

Where:

TCFr2 = The achieved handicap for a boat that has not been highlighted as an extreme performer.

ΣTCF = The sum of the handicaps used by the boats that were not highlighted as extreme performers.

ΣAS2 = The sum of adjustment scales for the boats that were not highlighted as extreme performers.

AS2 = The adjustment scale for a boat that was not highlighted as an extreme performer. (100/E)

Once the TCFr2 for all remaining boats has been calculated the next race handicap for each boat is calculated, similarly to the boats highlighted as extreme performers. These are calculated by adding a percentage of the used and achieved handicap (calculated in the absence of extreme performers). Similar to extreme performers these percentages differ dependant on over or under performance. For a boat that is not an extreme performer and over performs, the next race handicap is 70% of the used handicap and 30% of the achieved handicap. For a boat that under achieved but is not an extreme performer the next race handicap is 85% of the used handicap and 15% of the achieved handicap.

Expressed mathematically as:

For over performance; TCFn = (TCF x 0.7) + (TCFr2 x 0.3)

For under performance; TCFn = (TCF x 0.85) + (TCFr2 x 0.15)

Where:

TCFn = The next race handicap for a boat not highlighted as an extreme performer.

TCF = The Handicap used.

TCFr2 = The Achieved Handicap calculated in the absence of extreme performers.

Finally for all the calculated handicaps for the next race, irrespective of extreme performance, all handicaps are realigned against their base number to ensure that at any point within a series the current handicaps are relative to the base list ensuring a new boat entering the series does not have a relatively advantageous handicap. This is done by dividing the sum of the base numbers for the boats that took part in the race by sum of the next race handicaps to calculate a realignment factor. Each next race handicap is then multiplied by the realignment factor to return the boats realigned handicap. This is then automatically applied to the boats next race within NHC.

Expressed mathematically as:

RF = (ΣBN/ ΣTCFn/TCFnex)

Where:

RF = Realignment factor.

ΣBN = The sum of the base numbers for the boats that took part in the race.

ΣTCFn/TCFnex = The sum of the next race handicaps for both extreme and non extreme boats that took part in the race.

TCFnra = TCFn/TCFnex x RF

Where: TCFnra is the boats realigned handicap that is applied to the next race they take part in.

TCFn/TCFnex = the next race handicap for either an extreme performer or standard performer.

If a boat does not compete in a race it's handicap is not analysed and is not realigned.