

PORTSMOUTH YARDSTICK
Section III

**CALCULATION OF PORTSMOUTH NUMBERS (D-PN)
AND WIND HANDICAP FACTORS (HC)**

A. CALCULATION FOR UNLISTED OR UNRATED CLASSES

Preferably, an unlisted or unrated boat is handicapped after trial races against one or more Yardstick boats and Portsmouth Numbers determined by methods outlined in Section III C. When this is not possible, alternate methods are offered for approximating D-PN based upon linear regression correlations that have been derived from working with Portsmouth Numbers.

The basic formulae for estimating D-PN from rating systems is: $D-PN = A + [B(\text{Rating})]$

To improve the accuracy of the estimated numbers, classes are grouped into various types, based on similarity within class types and/or performance across the wind spectrum. These class types plus the various rating formulae are given in Table III.

Linear regression coefficients (A) and (B) for calculation of D-PN are given in Table IV for the various rating systems. Length, weight and sail area used in the various rating formulae are found in buyers' guides, manufacturers' literature, etc.

1) Centerboard Classes

Portsmouth Numbers for centerboard classes may be determined from a measured rating (MR) involving over-all and waterline lengths and sail area.

2) Multihull Classes

Portsmouth Numbers for multihull classes may be determined from modified formulae of the Pacific Multihull Association (PMA). Crew number and weight in addition to length and sail area are required. North American Multihull Sailing Association (NAMSA) Portsmouth Numbers (PNs) also can be related to US SAILING Portsmouth D-PNs, with wind HC ratings being used depending on average wind velocities versus normal NAMSA trapeze adjustments based on a race committee's observance during each race.

3) Keelboat Classes

Portsmouth Numbers for keelboat classes may be determined from derived ratings (DR) requiring waterline length, sail area and displacement for calculation.

4) Offshore Classes

Portsmouth Numbers for offshore classes may be determined from derived ratings (DR) or from various associated ratings (PHRF, MORC and IOR). This ranking does not reflect on the merits of the various systems but on our limited amount of data for determining the linear regression coefficients for rating formulae and ability to make class type assignments.

B. CALCULATION OF HC FROM D-PN

For those instances in the Tables where Wind Velocity Handicap Factors (HC) are not listed or for calculations for unlisted classes, generalized factors (f) may be used to calculate HC from the Basic Portsmouth Number (D-PN) using the relation: $HC = (f)(D-PN)$. Generalized factors are given in Table IV for various classes and boat types.

C. CALCULATION OF D-PN AND HC FROM RACE DATA

Some clubs may wish to calculate D-PN or HC from their race data. The following procedure, while not as sophisticated as methods in the computer programs employed by the US SAILING PN Committee, will yield results consistent with those in the Tables.

First, identify a reference class, or classes, participating in the race. The reference classes (Primary and Secondary Yardsticks) and Yardstick values as a function of Beaufort Number (BN) are given in Table VII. If more than one reference class has participated, an average reference Wind Velocity Handicap Factor and an average reference elapsed time may be calculated for a theoretically ideal reference boat for the race.

Average Wind Velocity Handicap for reference classes:

$HC_{avg} = \frac{\sum(HC_i)}{n}$ where i refers to each reference class and $n = \sum_i$ i.e., total number of reference classes. If

BN for race is unknown, or is greater than 6, use D-PN value given in Table VII. For HC for reference

classes, average elapsed time equals $ET_{avg} = HC_{avg} \frac{\sum\left(\frac{ET}{HC_i}\right)}{n}$ and $\frac{ET}{HC_i}$ equals elapsed time divided by Wind

Velocity Handicaps for each reference class. HC_{avg} and ET_{avg} are then used for calculation of a wind

handicap factor for those boats in the race that are designated by: $HC_{j,BN} = \frac{(ET_{j,BN})(HC_{avg,BN})}{ET_{avg,BN}}$ where j refers

to boat and BN to Beaufort Number of the race; i.e., data kept by class and BN. Data are then averaged

for each class and BN. Unknown BNs should be designated BN=X. $HC_{j,avg,BN} = \frac{\sum(HC_{j,BN})}{n}$ where $n = \sum_j$ i.e.,

the total number of data points for each class by BN.

For calculation of D-PN and HC for wind ranges, Weight Factors (WF) have been assigned for each Beaufort Number (Table II).

The basic D-PN is calculated by summing averages over all BNs by $D - PN_j = \frac{\sum_{BN} (HC_{j,avg,BN})(WF_{BN})}{\sum_{BN} (WF_{BN})}$

Where a BN range is desired (e.g., 0-1), use averages and weight factors for BN=0 and BN=1, and etc.