World Leader in Rating Technology

OFFSHORE RACING CONGRESS

ORC Rating Systems 2018

ORC International & ORC Club

Cover picture: ORC European Championship, Gdansk, Poland 2017
Courtesy Robert Hajduk

Margin bars denote rule changes from 2017 version

ORC

World leader in Rating Technology

ORC RATING SYSTEMS

ORC International Club

2018

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CONTENTS

Introduction

ORC Rating systems (ORC International and ORC Club) use the International Measurement System (IMS) as a measurement platform and the ORC Velocity Prediction Program (VPP) to rate boats of different characteristics in size, hull and appendages shape and configuration, stability, rig and sails measurement, propeller installation and many other details affecting their theoretical speed. Boat ratings are calculated from the predicted boat speeds, calculated for 7 different true wind speeds (6-8-10-12-14-16–20 knots) and 8 true wind angles (52°-60°-75°-90°-110°-120°-135°-150°), plus the 2 "optimum" VMG (Velocity Made Good) angles: beating (TWA=0°) and running (TWA=180°), which are calculated obtaining an optimum angle at which the VMG is maximized.

From this matrix of predicted performances a variety of handicaps are derived, and corrected times can be obtained, selecting from a variety of options that range from the Single number and Triple number scoring methods based on Time-on-Distance or Time-on-Time, to the "automated" methods such as the simple Performance Line Scoring (PLS) or the more sophisticated Performance Curve Scoring (PCS).

The VPP is explained in detail in the VPP Documentation guide and is the basis of the ORC handicap system. A VPP simulation software package can be purchased to study the theoretical boat speeds derived from the calculations when using IMS measurements. Details and order forms are available at the ORC website: www.orc.org.

Users of ORC Rating systems should consult the Administrative part of the IMS (Part A) for appropriate use of abbreviations, definitions, and symbols.

ORC International certificates may be issued for boats which are completely measured in accordance with the IMS and complying with the requirements of the IMS Rules and Regulations, as well as those expressed in this document.

In contrast, ORC Club certificates may be issued with less than complete IMS measurement where measurement data may be declared and/or obtained from other sources. The Organizing Authority of any race or regatta will specify whether ORC International or ORC Club certificates are required for entry, but both certificate types can be mixed in any race, being fully compatible.

The following measurements with appropriate IMS rules are used for the ORC Rating systems:

Hull and appendages in the symmetry plane

	OFF file	B3
FFM	Freeboard Forward Measured	B5.3
FAM	Freeboard Aft Measured	B5.4
SG	Water Specific Gravity	B5.5
	Other Hull Measurements	B7

Appendages not included in the OFF File

	Centerboard	C2
	Twin Rudders	C3
	Bilgeboard	C4
	Trim tab	C5
	Dynamic Stability System	C6

Propeller

	Propeller Type	D2
	Propeller Installation	D3
	Propeller Measurements	D4

Stability

PLM	Length of Manometer	E2.3
GSA	Gauge Surface Area	E2.4
RSA	Reservoir Surface Area	E2.5
WD	Weight Distance	E2.7
W1-4	Inclining Weights	E2.8
PD1-4	Pendulum Deflections	E2.9
WBV	Water Ballast Volume	E3.1
LIST	Average List Angle	E3.4
CANT	Average Canting Angle	E6.3

Rig

P	Mainsail Hoist	F2.1
IG	Forestay Height	F3.1
ISP	Height of Spinnaker Hoist	F3.2
BAS	Boom Above Sheerline	F3.4
MDT1	Max. Transverse Mast	F4.1
MDL1	Max. Fore-and-Aft Mast	F4.2
MDT2	Min. Transverse Mast	F4.3
MDL2	Min. Fore-and-Aft Mast	F4.4
TL	Taper Length	F4.5
MW	Mast Width	F4.6
GO	Forestay Outrigger	F4.7
E	Mainsail Foot	F5.1
BD	Boom Diameter	F5.2
J	Foretriangle Base	F6.1
SFJ	Stem to Forward End of J	F6.2
FSP	Forestay Perpendicular	F6.5
SPL	Spinnaker Pole Length	F7.1
TPS	Tacking Point of Spinnaker	F7.2
MWT	Mast Weight	F8.1
MCG	Mast Vertical Center of Gravity	F8.3
	Other Rig Measurements	F9

Mizzen Rig

PY	Mainsail Hoist Mizzen	F10.1
BASY	Boom Above Sheerline Mizzen	F10.1
MDT1Y	Max. Transverse Mast Mizzen	F10.1
MDL1Y	Max. Fore-and-Aft Mast Mizzen	F10.1
MDT2Y	Min. Transverse Mast Mizzen	F10.1
MDL2Y	Min. Fore-and-Aft Mast Mizzen	F10.1
TLY	Taper Length Mizzen	F10.1
EY	Mainsail Foot Mizzen	F10.1
BDY	Boom Diameter Mizzen	F10.1
IY	Height of Mizzen Staysail Hoist	F10.2
EB	Distance Between Masts	F10.3

Sails

MHB	Mainsail Top Width	G2.1
MUW	Mainsail Upper Width	G2.1
MTW	Mainsail 3/4 Width	G2.1
MHW	Mainsail 1/2 Width	G2.1
MQW	Mainsail 1/4 Width	G2.1
MHBY	Mizzen Top Width	G3
MUWY	Mizzen Upper Width	G3
MTWY	Mizzen 3/4 Width	G3
MHWY	Mizzen 1/2 Width	G3
MQWY	Mizzen 1/4 Width	G3
HHB	Headsail Top Width	G4.1
HUW	Headsail Upper Width	G4.1
HTW	Headsail 3/4 Width	G4.1
HHW	Headsail 1/2 Width	G4.1
HQW	Headsail 1/4 Width	G4.1
HLU	Headsail Luff	G4.1
HLP	Headsail Perpendicular	G4.1
SHW	Symm. Spinnaker Mid Width	G6.4
SFL	Symm. Spinnaker Foot	G6.4
SLU	Symm. Spinnaker Luff	G6.4
SLE	Symm. Spinnaker Leech	G6.4
SHW	Asymm. Spinnaker Mid Width	G6.5
SFL	Asymm. Spinnaker Foot	G6.5
SLU	Asymm. Spinnaker Luff	G6.5
SLE	Asymm. Spinnaker Leech	G6.5

1. LIMITS AND DEFAULTS

100 General

100.1 The IMS Measurement dataset of any boat is processed by the Lines Processing Program (LPP) which calculates hydrostatics and all hull characteristics required by the VPP. The calculations of the main hydrostatic data are explained in principle below, while the exact formulations are defined in the VPP and its documentation.

100.2 Default water specific gravity ***SG*** shall be 1.0253. FA and FF shall be adjusted from the measured freeboards ***FAM*** and ***FFM*** depending on the difference between ***SG*** at the time of measurement and the default value defined above. All hydrostatic calculations are then made using the flotation plane in nominal seawater, i.e. with default specific gravity. FA and FF also include freeboards adjustments for the boats measured in measurement trim before 31.12.2012. Freeboards are adjusted based on deduction of total weight and longitudinal position of items recorded in the measurement inventory at the time of measurement and not included in IMS B4.1.

100.3 Sailing Trim shall be the plane of flotation derived from Measurement Trim as in 100.2 with the addition of weight to represent crew, sails and gear.

100.4 Height of Base of I (MHBI) is the calculated freeboard in Sailing Trim at the base of IG and ISP. It is used to establish the height of the center of effort of the sailplan.

100.5 DSPM and DSPS are the displacements calculated from the volume resulting from the linear integration of the immersed section areas obtained from the hull lines of the Offsets and the freeboards afloat, adjusted to the standard ***SG,*** in Measurement Trim and Sailing Trim respectively. DSPM is printed on the ORC certificate.

100.6 The Sailing Length (IMS L) is an effective sailing length which takes into account the hull shape along its length and especially at the ends of the yacht, both above and below the plane of flotation in Sailing Trim. L is a weighted average of lengths for three conditions of flotation: two with the yacht upright and one with the yacht heeled. The lengths for the three conditions of flotation from which L is calculated are second moment lengths derived from immersed sectional areas attenuated for depth and adjusted for appendages. The second moment lengths are:

LSM0 is for the yacht in Measurement Trim floating upright.
LSM1 is for the yacht in Sailing Trim floating upright.
LSM2 is for the yacht in Sailing Trim floating with 2 degrees heel.
LSM3 is for the yacht in Sailing Trim floating with 25 degrees heel.
LSM4 is for the yacht in a sunk condition such that compared to Sailing Trim it is sunk 0.025*LSM1 forward and 0.0375*LSM1 aft, floating upright.

The LPP calculates LSM's taken from the canoe body without appendages and from the full hull with appendages. The final LSM's are the averages of full hull and canoe body LSM's. IMS L is a fundamental parameter taken into account by the VPP in determining hull resistance and it is calculated as:

$$L = 0.3194 \cdot (LSM1 + LSM2 + LSM4)$$

100.7 The effective beam B is a mathematical expression of beam in which elements of beam throughout the immersed portion of the hull are taken into account with emphasis on beam elements close to the plane of flotation and remote from the ends of the hull. It is derived from the transverse second moment of the immersed volume attenuated with depth for the yacht in Sailing Trim floating upright.

100.8 The effective hull depth T is a depth-related quantity for the largest immersed section of the hull. It is derived from the area of the largest immersed section attenuated with depth for the yacht in Sailing Trim floating upright divided by B.

100.9 The Beam Depth Ratio BTR is the effective beam divided by the effective hull depth BTR = B/T.

100.10 The Maximum Draft of the Hull including fixed keel shall be the vertical distance from the Sailing Trim plane of flotation to the lowest point of fixed keel. For a centerboard, when ***KCDA*** is measured and recorded, the maximum draft shall be decreased by ***KCDA***.

100.11 VCGD is the vertical centre of gravity distance from the datum line in the hull offset file, while VCGM is the vertical centre of gravity from the measurement trim waterline.

101 Materials

101.1 It is the intention of the ORC Rating Systems to promote safety, address cost and allow materials that are readily available while prohibiting materials and processes that are not readily available.

101.2 The following materials and processes are prohibited for modifications on existing boats or on boats with Age Date from 2018:

a) In hull and deck shell structures: Carbon fiber with modulus exceeding 320 GPa.

b) In spars with the exception of booms, bowsprit and spinnaker poles: Cored sandwich construction where the core thickness at any section exceeds the thickness of the two skins.

c) Material with density greater than 11340 kg/m^3.

d) Pressure applied in the manufacture of hull and deck structures greater than 1 atmosphere.

e) Temperature applied in the manufacture of hull and deck shell structures greater than 90°C.

f) Aluminium honeycomb cores in hull shell and deck shell structures.

g) In hull shell and deck shell structures: Plastic foam core of nominal density less than 60 kg/m3.

102 Crew Weight

102.1 The maximum crew weight may be declared by the owner.

102.2 If the maximum crew weight is not declared it shall be taken as default calculated to the nearest kilogram as follows:

$$CW = 25.8 \cdot LSM0^{1.4262}$$

102.3 Minimum crew weight may be applied by the Notice of Race and Sailing Instructions and shall be calculated as follows:

Minimum CW = Maximum CW – (the greater of: 25% of Maximum CW or 85 kg).

102.4 The possibility of extending crew position beyond the IMS sheerline is taken into account through CEXT factor in accordance with ORC Sportboat Class Rules.

103 Hull

103.1 Age Allowance (AA) is a credit for age of 0.0325% of ratings increase for each year from Age or Series Date to the current rule year up to maximum of 15 years (0.4875%).

103.2 Dynamic Allowance (DA) is a credit representing the dynamic behavior of a boat taking into account performance in unsteady states (i.e. while tacking) calculated on the basis of: Upwind Sail Area/Volume ratio, Upwind Sail Area/Wetted Surface ratio, Downwind Sail Area/Volume ratio, Downwind Sail Area/Wetted Surface ratio and Length/Volume ratio.

It is fully applied to the ratings of Cruiser/Racers, while for the Performance boats it is applied incrementally with only 20% of the full calculated DA applied in the fourth year and a further 20% in each of the following years until the full DA is applied in the eighth year.

103.3 NMP (Non Manual Power) is the penalty coefficient for boats using non-manual power as defined in 204(b), where the penalty coefficients are summarized as follows:

Category according to the IMS Appendix 1	*Performance*	*Cruiser/Racer*
Adjusting sheets to trim clew of a sail, or a boom	0.25 %	0.375 %
Adjusting backstay, vang or outhaul	0.25 %	0.125 %

If the declared crew weight as in 102.1 is smaller than default crew weight as in 102.2, the penalty is decreased by multiplying appropriate penalty coefficient with:

$$NMP_{final} = NMP \cdot \left(\frac{CW_{declared}}{CW_{default}} \right)^2 [\%]$$

104 Appendages

The longitudinal movement of the center of gravity of a centerboard when it is being raised or lowered shall not exceed 0.06 * ***LOA***.

105 Propeller

105.1 PIPA shall be the propeller installation projected area calculated on propeller type, installation and measurements.

105.2 For twin propeller installation, PIPA is doubled.

106 Stability

106.1 ORC Stability Index shall be calculated as follows:

Stability Index = LPS + Capsize Increment (CI) + Size Increment (SI)

$$CI = 18.75 \cdot \left(2 - \frac{MB}{\sqrt[3]{DSPM/64}} \right) \qquad SI = \frac{\left(\frac{12 \cdot \sqrt[3]{DSPM/64} + LSM0}{3} \right) - 30}{3}$$

DSPM – Displacement in measurement trim calculated by the VPP
LSM0 – Second moment length calculated by the VPP

CI shall not be taken as greater than 5.0.
SI shall not be taken as greater than 10.0.

106.2 For a boat with water ballast or canting keel, the Ballast Leeward Recovery Index (BLRI) represents such a boat's relative ability to recover from a knock down with sails aback, i.e., knocked down with all water ballast or canting keel to leeward. BLRI shall be calculated as follows:

$$BLRI = 0.5 + 0.3333 \cdot BALL_{FR} \qquad \text{for } BALL_{FR} <= 1.5$$

$$BLRI = 0.5 + 0.0833 \cdot BALL_{FR} \qquad \text{for } BALL_{FR} > 1.5$$

where

$$BALL_{FR} = \frac{RA90lee \cdot DSPS}{2 \cdot SA \cdot CEH}$$

and the following values taken with full leeward cant or leeward ballast tankage full, windward empty, calculated by the VPP, in metric units:

RA90lee - Righting arm, 90 degrees heel, sailing trim
DSPS - Displacement in sailing trim
SA - Sail area calculated as rated mainsail + fore triangle (***IG*** · ***J*** · 0.5) + rated mizzen
CE - Geometric center of effort of such defined sail area

107 Righting Moment

107.1 When an inclining test is performed with weights that are transferred once from starboard to port side and the angle recorded four times in succession, the measured righting moment shall be calculated as follows:

$$RM_{(1-4)} = W_{(1-4)} \cdot 0.0175 \cdot WD \cdot \frac{PL}{PD_{(1-4)}} \qquad RM_{measured} = \frac{RM_1 + RM_2 + RM_3 + RM_4}{4}$$

107.2 When an inclining test is performed with four weights that are transferred one by one from starboard to port side, the measured righting moment shall be calculated as follows:

$$RM_{measured} = WD \cdot PL \cdot \frac{0.0175}{SLOPE}$$

where

PL = ***PLM***/(1+***GSA***/***RSA***)
SLOPE = (4.0*SUMXY-SUMY*SUMX) / (4.0*SUMXSQ-SUMX^2)

SUMX - the sum of the inclining weights ***W1***+***W2***+***W3***+***W4***
SUMY - the sum of the pendulum deflections ***PD1***+***PD2***+***PD3***+***PD4***, referenced to datum point.
SUMXSQ - the sum of the squares of the inclining weights ***W1***^2 + ***W2***^2 + ***W3***^2 + ***W4***^2
SUMXY - the sum of the products of the inclining weights multiplied with their corresponding pendulum deflections ***PD1****W1*** + ***PD2****W2*** + ***PD3****W3*** + ***PD4****W4***

The slope of a least squares fit straight line through the inclining weight vs. pendulum deflection is determined iteratively, plotting in turn each of the five possible combinations of four selected data points, as referenced to the fifth point. Of the five alternative plots, the one yielding the fit with the highest correlation coefficient determines RM.

107.3 For boats with movable boards or drop keels, the righting moment is corrected to: RMC=RM+0.0175*(***WCBA****CBDA*+***WCBB****CBDB***). For yachts with fixed keels or centerboards locked to prevent any movement: RMC=RM.

107.4 Default righting moment shall be calculated as follows:

$$RM_{default} = 1.025 \cdot \left(a0 + a1 \cdot BTR + a2 \cdot \frac{\sqrt[3]{DSPM}}{IMSL} + a3 \cdot \frac{SA * HA}{B^3} + a4 \cdot \frac{B}{\sqrt[3]{DSPM}} \right) \cdot DSPM \cdot IMSL$$

where all the variables are calculated by the VPP

a0 = -0.00410481856369339 (regression coefficient)
a1 = -0.0000399900056441(regression coefficient)
a2 = -0.0001700878169134 (regression coefficient)
a3 = 0.00001918314177143 (regression coefficient)
a4 = 0.00360273975568493 (regression coefficient)
DSPM - displacement in measurement trim
SA - sail area upwind
HA - heeling arm, defined as (CEH main*AREA main + CEH headsail*AREA headsail) / SA + MHBI + DHKA*0.45, for mizzen (CEH headsail*AREA headsail + CEH mizzen*AREA mizzen) is added to the numerator
CEH - height of centre of effort
DHKA - Draft of keel and hull adjusted
Default righting moment shall not be taken greater than 1.3*$RM_{measured}$ nor smaller than 0.7*$RM_{measured}$.

For movable ballast boats the default righting moment intends to predict the righting moment of the boat without the effect of movable ballast (water tanks empty, or keel on the center plane), is then decreased by a factor (1- RM@25_movable/RM@25_tot), where RM@25_movable is the righting moment due to the contribution of movable ballast at 25 degrees of heel, and RM@25_tot is the total

righting moment at 25 degrees, with keel canted or windward tanks full. For these boats, the max and min bounds are set to 1.0* $RM_{measured}$ and 0.9* $RM_{measured}$ respectively.

107.5 The rated righting shall be calculated as follows:

$$RM_{rated} = \frac{2}{3} \cdot RM_{measured} + \frac{1}{3} \cdot RM_{default}$$

If righting moment is not measured or obtained from another source, the rated righting moment shall be taken as:

$$RM_{rated} = 1.03 \cdot RM_{default}$$

and shall not be taken less then one giving the Limit of positive stability (LPS) of 103.0 degrees or 90.0 degrees for an ORC Sportboat.

107.6 If the vertical, longitudinal and transversal centre of gravity of the water ballast are not measured, each shall be taken as follows:

VCGwb = 0.5 * ***FA***
LCGwb = 0.7 * ***LOA***
TCGwb = 0.9 * Crew Arm

108 Rig

108.1 The upper end of any rigging shall be attached to the mast above a point 0.225***IG*** above the sheerline, except that there may be a temporary support to the mast near the spinnaker pole when the spinnaker is set.

108.2 ***P*** + ***BAS*** shall not be less than the greater of 0.96***IG*** or 0.96***ISP***.

108.3 Boom diameter by default shall be 0.06***E***. If ***BD*** exceeds this default, the mainsail rated area shall be increased as defined in 109.2.

108.4 Foretriangle height IM shall be calculated as follows:

$$IM = \left(IG + \frac{IG \cdot (GO - MW)}{J - GO + MW} \right)$$

IM shall not be taken as less than 0.65*(***P*** + ***BAS***).

108.5 If ***TPS*** is measured and bowsprit is recorded as moveable sideways in accordance with IMS F7.3 it shall be considered by the VPP as a spinnaker pole with SPL = TPS.

109 Mainsail

109.1 Mainsail measured area shall be calculated as follows:

$$Area = \frac{P}{8}\left(E + 2 \cdot MQW + 2 \cdot MHW + 1.5 \cdot MTW + MUW + 0.5 \cdot MHB\right)$$

If any of mainsail widths are not measured, they shall be taken as:

MHB = 0.05 * ***E***
MUW= 0.25 * ***E***
MTW = 0.41 * ***E***
MHW= 0.66 * ***E***
MQW= 0.85 * ***E***

Mainsail measured area is calculated by the simplified trapeze formula above, dividing the luff in amounts of 1/4, 1/2, 3/4 and 7/8. Mainsail rated area is calculated by using the actual heights on the luff from the tack point to the points where mainsail girths are measured. These actual heights are calculated as follows:

$$MHWH = \frac{P}{2} + \frac{MHW - E/2}{P} \cdot E$$

$$MQWH = \frac{MHWH}{2} + \frac{MQW - (E + MHW)/2}{MHWH} \cdot (E - MHW)$$

$$MTWH = \frac{MHWH + P}{2} + \frac{MTW - MHW/2}{P - MHWH} \cdot MHW$$

$$MUWH = \frac{MTWH + P}{2} + \frac{MUW - MTW/2}{P - MTWH} \cdot MTW$$

Mainsail rated area is then calculated as follows:

$$Area = \frac{MQW + E}{2} \cdot MQWH + \frac{MQW + MHW}{2} \cdot (MHWH - MQWH) +$$
$$+ \frac{MHW + MTW}{2} \cdot (MTWH - MHWH) + \frac{MUW + MTW}{2} \cdot (MUWH - MTWH) +$$
$$+ \frac{MUW + MHB}{2} \cdot (P - MUWH)$$

Thereby, the amount of roach will proportionally increase the rated area from the measured one. Mainsail rated area shall be the largest rated area of any mainsail in the sails inventory.

109.2 If ***BD*** exceeds its limit set up in 108.3, mainsail rated area shall be increased by 2****E****(***BD*** - 0.06****E***).

110 Mizzen

Mizzen width defaults and rated area shall be calculated as for the mainsail with corresponding measurements.

111 Headsail

111.1 Headsail measured area shall be calculated as follows:

$$Area = 0.1125 \cdot HLU \cdot (1.445 \cdot HLP + 2 \cdot HQW + 2 \cdot HHW + 1.5 \cdot HTW + HUW + 0.5 \cdot HHB)$$

The measured area of a headsail with a distance between the **half luff point** and **half leech point** of 55% or more of the **foot length** (formerly known as Code 0) measured before 01/01/2014 with **SLU**, **SLE**, **SFL** and **SHW** shall be calculated as follows:

$$ASL = \frac{SLU + SLE}{2}$$

$$Area = 0.94 \cdot \frac{ASL \cdot (SFL + 4 \cdot SHW)}{6}$$

111.2 For headsails without a leech roach, if any of its widths are not measured, it shall be taken as follows:

HHB = 0.020 * ***HLP***
HUW = 0.125 * ***HLP*** + 0.875 * ***HHB***
HTW = 0.250 * ***HLP*** + 0.750 * ***HHB***
HHW = 0.500 * ***HLP*** + 0.500 * ***HHB***
HQW = 0.750 * ***HLP*** + 0.250 * ***HHB***

Headsails with a leech roach shall be completely measured.

111.3 Headsail rated area shall be the largest measured area for each of headsail set on the forestay and headsail **set flying** in the sails inventory, but shall not be taken less than:

$0.405 \cdot J \cdot \sqrt{IM^2 + J^2}$ or

$0.405 \cdot TPS \cdot \sqrt{ISP^2 + TPS^2}$ for headsails **set flying**.

However, headsail **set flying** will not be taken into VPP calculations if its area is less than the smaller of:

a) its minimum area as defined above

b) the largest measured area of the headsail set on the forestay

111.4 Aerodynamic lift coefficients of the VPP calculation will be selected for different conditions as follows:

a) Headsail set on the forestay

b) Headsail **set flying**

c) Headsail **set flying** with tight luff having

$HLU < \sqrt{ISP^2 + TPS^2}$ and $HHW < 0.6 \cdot LPG$

or when there are battens on the headsail

Lift coefficients for option c) are used whenever there is one headsail in the sails inventory with tight luff.

If any of the headsails set flying in the sails inventory have battens, the lift coefficients are multiplied with an appropriate factor.

Additionally, aerodynamic lift coefficients are credited in the upwind angles (AWA < 50) for each of the following:

d) If there is a headsail furler on a fixed forestay used in association with only one headsail in accordance with IMS F9.8

e) If all headsails and the mainsail are made of woven polyester.

112 Mizzen Staysail

Mizzen staysail rated area shall be calculated as follows:

$$Area = YSHW \cdot (0.5 \cdot YSHW + 0.25 \cdot YSFL)$$

113 Symmetric Spinnaker

113.1 Symmetric spinnaker measured area shall be calculated as follows:

$$Area = \frac{SLU \cdot (SFL + 4 \cdot SHW)}{6}$$

Symmetric spinnaker rated area shall be the largest measured area of any symmetric spinnaker in the sails inventory, but it shall not be taken less than:

$1.14 \cdot \sqrt{ISP^2 + J^2} \cdot \max(SPL; J)$

113.2 If any of SLU, SLE, SHW or SFL is not measured, it shall be taken as follows:

$$SLU = SLE = 0.95 \cdot \sqrt{ISP^2 + J^2}$$

$$SFL = 1.8 \cdot \max\left(SPL; J\right)$$

$$SHW = 1.8 \cdot \max(SPL; J)$$

If SPL is not measured it shall be taken as ***J***.

113.3 If there is no spinnaker measured, the boat will be rated with an asymmetric spinnaker of *Area* = 1.064 * *Area* of the largest headsail set on the forestay.

114 Asymmetric Spinnaker

114.1 The asymmetric spinnaker luff shall be calculated as

$$ASL = \frac{SLU + SLE}{2}$$

114.2 Measured area for Asymmetric spinnaker shall be calculated as follows:

$$Area = \frac{ASL \cdot (SFL + 4 \cdot SHW)}{6}$$

The asymmetric spinnaker rated area shall be the largest measured area of any asymmetric spinnaker in the sails inventory, but it shall not be taken less than:

$$0.6333 \cdot \sqrt{ISP^2 + J^2} \cdot \max(1.8 \cdot SPL; 1.8 \cdot J; 1.6 \cdot TPS)$$

114.3 If either of SLU, SLE, SHW or SFL are not measured, each shall be taken as follows:

$$ASL = 0.95 \cdot \sqrt{ISP^2 + J^2}$$

$$SFL = \max\left(1.8 \cdot SPL; 1.8 \cdot J; 1.6 \cdot TPS\right)$$

$$SHW = \max\left(1.8 \cdot SPL; 1.8 \cdot J; 1.6 \cdot TPS\right)$$

If TPS is not measured, it shall be taken as ***J*** + ***SFJ***.

2. RULES APPLYING WHILE RACING

200 Crew Weight and Position

200.1 The weight of all crew members on board while racing weighed in light street clothes shall not be:

a) greater than the maximum crew weight as defined in 102.1 and 102.2
b) smaller than the minimum crew weight as defined in 102.3, when applied by the Notice of Race and Sailing Instructions.

200.2 RRS 49.2 is modified by deleting "sitting on the deck" in the second sentence.

201 Ballast, Fixtures and Equipment

201.1 The second sentence of the RRS 51 does not apply for the water ballast and/or canting keel systems and it is modified by adding as non-movable items recorded in the measurement inventory (IMS B4.4).

201.2 Unwarranted quantities of stores shall be considered as ballast. Any liquid carried on board in excess of 2.5 liters of drinkable fluid per person per day of racing, in the tanks or in other containers exclusive of emergence water required by the Offshore Special Regulations, and any fuel in excess of the quantity needed to motor for 12 hours is not permitted. Race Organizers may waive this requirement by specifying so in the Notice of Race.

201.3 Portable equipment, gear, sails and stores may only be moved from stowage for use in their primary purpose. Stowage in this respect is the position for any item of equipment or stores, to be maintained for the duration of a race or series, when such item is not in use for its primary purpose. Note: Moving sails or equipment with the intention of improving performance is prohibited and shall be considered as a breach of RRS 51, although this may be changed by the Notice of Race.

202 Drop Keels and Movable Appendages

If any drop keel or movable appendage is to be locked when *racing* it shall be locked so and the locking device shall be in place.

203 Centerboards

The movement of a centerboard or drop keel while *racing* shall be restricted to one of the following:

a) Straight extension or retraction as in a dagger board.

b) Extension about a single fixed pivot.

204 Manual Power

RRS 52 is modified. Non-manual power may be used for:

a) canting keel and water ballast systems

b) halyards, sheets to trim clew of a sail or a boom, backstay, vang or outhaul

205 Rig

205.1 Movement of the mast at the step or deck is not permitted, except for a natural movement of the mast at the deck not exceeding 10 per cent of the greatest fore and aft or transverse dimension of the mast.

205.2 If aboard, a mast jack pump shall not be used while racing.

206 Sails

206.1 Exclusive of storm & heavy weather sails required by the Offshore Special Regulations, a boat shall not carry aboard while *racing* more sails of each type than the numbers defined as follows:

CDL	**Above 17.00**	**17.000 – 11.501**	**11.500 – 9.651**	**Below 9.651**
Mainsail	1	1	1	1
Headsails	8	7	6	5
Spinnakers	6	5	4	3
Mizzen Staysail	1	1	1	1
Mizzen	1	1	1	1

If there is a headsail used with a headsail furler as recorded in accordance with IMS F9.8 and credited in accordance with 111.4(d) only one headsail shall be aboard while racing. That headsail shall be of area not less than 95% of the largest headsail set on the forestay recorded on the certificate.

206.2 The Notice of Race and Sailing Instructions may modify limitations set in 206.1 appropriate to the character of the race.

206.3 Operating devices for securing halyards under tension (e.g. halyard locks) shall be permitted only if they can be remotely operated from the deck.

206.4 Sails shall be set as defined in ERS B1 and rules 207 – 210 bellow.

207 Mainsail and Mizzen

When set on the mast the **head point** shall be the highest point of the **luff**. Mainsail and mizzen luff shall be reefed only from its bottom part or with a furling system in the mast.

208 Headsails

208.1 Headsails may be set on the forestay or **set flying**.

208.2 Headsails set flying may be tacked:

a) in front of the forestay, when

i) it shall be tacked approximately on the boat's centerline, except when it is tacked on a bowsprit that is recorded as movable sideways in accordance with IMS F7.3.
ii) it shall not be used when any spinnaker is set

b) between the forestay (included) and the mast, when

i) it shall have HLP<= 1.1*J
ii) it shall be tacked inside any spinnaker sheet
iii) it may be tacked out of the boat's centerline

208.3 If the headsail is **set flying**, no tack pennant greater than 0.762 m may be used.

208.4 The tension of the luff of a headsail **set flying** shall be adjusted only by means of the halyard or a tensioning device (e.g. purchase, hydraulic cylinder) attached to the **tack** below the **tack point**, and no tensioning attached to any luff intermediate points (e.g. cunningham holes).

208.5 Two headsails may be set on the same tack point, but only if no spinnaker is in use.

208.6 When more headsails are used at the same time, if they are trimmed flat along the centerline of the boat, the clew of the foremost-tacked headsail shall be aft of the clew of any other headsail trimmed on the same way.

208.7 Headsails may be sheeted:

a) to any part of the deck or rail

b) to a fixed point no higher than 0.05*$\boldsymbol{MB}$ above the deck or coach roof

c) to the main boom within the measurement limit according to IMS F5.3.

d) to the spinnaker pole in accordance with RRS 50.2 and 50.3(c).

Headsails shall not be sheeted to any other spar or outrigger.

209 Spinnakers

209.1 Spinnakers shall be **set flying**. If there is a luff wire, it shall be completely attached to the **luff**, with no voids between the sail and the luff wire.

209.2 Leech lines shall not be adjustable while *racing* on symmetric spinnakers.

209.3 Spinnakers may be tacked:

a) when ***TPS*** is recorded in the certificate: approximately on a boat's centerline, except when they are tacked on a bowsprit that is recorded as movable sideways in accordance with IMS F7.3

b) when ***SPL*** is recorded in the certificate: on the spinnaker pole

209.4 Where the asymmetric spinnaker is tacked on the centerline, tack pennants of whatever length may be used. Spinnakers shall be sheeted on the same side as the boom, except when gybing or maneuvering. Regardless, the tack of the spinnaker shall not be moved on the windward side with the help of afterguys and/or outriggers.

209.5 Spinnakers shall be sheeted:

a) from only one point

b) to any part of the rail or deck

c) to the main boom within the measurement limit according to the IMS F5.3

and shall not be sheeted to any other spar or outrigger.

209.6 Struts, spools or similar devices used solely for the purpose of keeping the spinnaker guy away from the windward shrouds are permitted only when the guy is attached to the pole and shall not to be used for any other purpose.

210 Mizzen Staysail

210.1 Mizzen staysail shall be sheeted:

a) to any part of the rail or deck

b) to the mizzen boom within the measurement limit according to the IMS F10.1

and shall not be sheeted to any other spar or outrigger.

210.2 The tack or tack pennant shall be secured abaft the point of intersection of the afterside of the mainmast with the main deck and must also be secured directly to and no higher than the rail cap, deck or cabin top (includes dog house top).

210.3 No more than one mizzen staysail shall be set at the same time.

210.4 No mizzen staysail shall be carried on a yawl or ketch whose mizzen is set on a permanent backstay in lieu of a mizzen mast.

211 Penalties

If any of the rules of ORC Part 2 are broken by the crew through no fault of their actions, the penalty imposed may be different from disqualification, including no penalty.

3. CERTIFICATES

301 Certificates

301.1 An **ORC International certificate** may be issued for a boat completely measured in accordance with the IMS and complying with the requirements of the IMS Rules and Regulations as well as ORC Rating systems. However, IMS hull measurement as defined in IMS Part B may be replaced by designer's data provided that:

a) The designer sends to the ORC hull data in 3D surface format (such as IGS) including the hull and all appendages with fore and aft water plane reference points which shall be marked on both sides of the hull, so that they can be used for flotation measurements. The longitudinal position of the reference points shall be inside the flotation waterline and not more than 0.05*LOA from the waterline ends

b) The ORC Central Rating Office will then create an offset file which shall be validated by checking one or more of the following:
- LOA, MB, deck beam at any stations, any section girth or height
- displacement calculated by the LPP from the freeboard measurements compared with one coming from actual weighing or calculated from the design waterline

This procedure shall be checked and approved by the ORC Chief Measurer and shall be used only for an exact type of boat with exact appendages for which data is provided by designer.

It is the owner's responsibility to ensure compliance, while the designer and builder shall confirm by a signed written declaration that the data provided are within the closest possible tolerances.

301.2 An **ORC Club certificate** may be issued with less than complete IMS measurements, in cases where measurement data may be:

a) Measured in accordance with the IMS

b) Declared by the owner. Any declared data may be taken or corrected by the Rating Authority if there is reasonable doubt about any declared data.

c) Obtained from any other source, including photos, drawings, designs, data from identical or similar boats.

302 One Design Certificates

302.1 ORC International and ORC Club certificates may be in the form of a One Design certificate where all data affecting a boat's rating are standardized based on the set of measurements for classes having One Design class rules or having all the IMS measurements in close tolerances. In such case no measurement is needed providing that there is proof that the boat is complying with the One Design Class measurements.

302.2 Any change of the One Design class measurements shall render invalid the boat's One Design certificate and a new standard ORC International or ORC Club certificate may be issued.

302.3 Data for the ORC International or ORC Club One Design Classes based on their class rules and actual IMS measurements of at least 5 measured boats shall be collected by the ORC to issue One Design certificates, whose data will be made available to the rating authorities when ORC is satisfied that the production of the class is within close tolerances. National rating authorities may issue One Design certificates for the national One Design Classes in their area when they are satisfied with the measurement data.

302.4 One Design measurement data may be changed from time to time due to changes in the Class Rules, IMS Rule or ORC Rating systems.

302.5 One Design certificates shall have the notation "One Design".

303 Certificate Issuing

303.1 Certificates shall be issued by the ORC Central Rating Office or by the National Rating Offices appointed by the ORC Nominating Bodies having a contract with the ORC for using ORC-certified computer software. A levy as determined by the ORC shall be paid for all valid certificates issued.

303.2 National Rating Offices shall be the Rating Authority in their areas and shall issue certificates for the boats normally stationed or racing in their jurisdiction. Measurement data of any boat shall be available and shared with any Rating Office, particularly when boats change area, owner, sail number, and are requesting certificates from several Rating Offices' jurisdictions. Offset file data will not be available to other parties without the written permission of the Designer.

303.3 The Rating Office shall have the authority to issue the certificate upon receipt of the measurement data, but if anything that can be considered unusual or against the general interest of the IMS Rule and Regulations or ORC Rating systems is found, the Rating Office may withhold the certificate pending an examination of the case and issue a certificate only after approval is obtained from the ORC.

303.4 The certificate shall be valid until the date printed on the certificate, which shall normally be the 31st of December of the current year.

303.5 A boat shall have only one valid certificate at any one time. The valid certificate shall be only the one issued last.

303.6 When the Rating Authority has reasonable evidence that not by her own fault a boat does not comply with her certificate, or that she should never have received a certificate, it shall withdraw the certificate, inform the owner or his representative in writing of the reasons for this withdrawal, re-check the data and

a) Re-issue a certificate if non-compliance may be corrected; or

b) If non-compliance may not be corrected by the Rating Authority, the certificate shall be invalidated and the owner or his representative shall be informed in writing.

303.7 The Rating Certificates once issued are considered public, and the Rating Authority shall supply a copy of any certificate to any person upon payment of a copying charge.

304 Owner's Responsibility

304.1 The owner or his representative shall be responsible for:

a) Preparing the boat for the measurement in accordance with the IMS

b) Declaring any required data to the measurer

c) Ensuring compliance of any measurement data to those printed on the certificate. Compliance with the certificate shall be defined as follows:

i) All measured, declared or recorded values shall be as close as possible to those on the certificate. Differences are allowed only if the values on the certificate give a worse rating (i.e., lower GPH)

ii) The sail area shall be smaller or equal to the respective one printed on the certificate. The sails inventory shall include the largest headsail set on the forestay and all headsails set flying.

iii) The actual crew weight shall not be considered as an issue of compliance with the certificate, but it is applied while racing in accordance with ORC Rule 200.

d) Using the boat and equipment as prescribed by the RRS, IMS Rule and ORC Rating Systems.

The owner or his representative shall sign the statement on the certificate: "I certify that I understand my responsibilities under ORC Rules and Regulations".

304.2 A certificate shall be automatically invalidated by a change of ownership. The new owner may request a new certificate with a simple declaration that no changes have been made so a new certificate may be issued without the need of any new measurement. Conversely the new owner has every right to have his boat re-measured.

304.3 Any change of the measurement data requires new measurement an issuing a new certificate. Such a change may be:

a) Changes of ballast in amount or location or configuration.

b) Change of tankage, fixed or portable, in size or location.

c) Any changes in the engine and/or propeller installation.

d) Addition, removal or change of location of gear or equipment, or structural alteration to the hull that affect the trim or flotation of the yacht.

e) Movement of any measurement bands used in sail area measurement, or any changes in spars, spar location or headstay position.

f) Any change to the size, cut or shape of the maximum area sails.

g) Changes to the shape of the yacht's hull and/or appendages

h) Changes to spars or standing rigging configuration, including elements of rigging identified as adjustable while *racing*.

i) Changes to the other hull measurements in accordance with the ORC Rule 304.

j) Any other change of the data in the certificate that affect any rating.

305 Measurement Protests

305.1 When, as a result of any pre-race inspection or measurement, it is determined that a boat does not comply with her certificate:

a) When the non-compliance is considered to be minor and can be easily corrected, the boat may be brought into compliance with her certificate, and, when necessary, a new certificate may be issued. The Measurer shall inform the Technical Committee of such a correction, who shall approve a new certificate issue.

b) When the non-compliance is major (even if it can be corrected) or if it cannot be corrected without requiring significant re-measurement, a boat shall not be eligible to enter a regatta. The Measurer shall inform the Technical Committee who shall act in accordance with the RRS and inform the Rating Authority.

305.2 When, as a result of any measurement protest by a boat or by the Technical Committee, it is determined that a boat does not comply with her certificate in accordance with 304.1(c)(i) and (ii), the non-compliance shall be calculated as a difference in percentage of GPH:

a) If the difference is less than or equal to 0.1%, the original certificate will be maintained, the protest will be dismissed, and the protestor will have to cover any cost involved. RRS 64.3(a) will apply but no corrections are needed.

b) If the difference is more than 0.1% but less than 0.25%, no penalty shall apply, but a new certificate shall be issued based on the new measurement data and all races of the series shall be rescored using the new certificate data. The Protest will be considered accepted and the protestee will have to cover any cost involved.

c) If the difference is 0.25% or more, a boat shall receive a scoring penalty that shall be 50% of the score for Did not Finish, rounded to the nearest whole number (0.5 rounded upward) in any race in which her rating was incorrect. The Protest will be considered accepted and the protestee will have to cover any cost involved and the yacht shall not race again until all non-compliance issues are corrected to the limit defined in a) above.

305.3 If a boat's certificate has to be recalculated during a race or series as a result of an error or an omission in the production of the certificate of which the boat owner could not have been reasonably aware, according to 303.6(a), all races of the series shall be rescored using the new data.

305.4 The results of a race or series shall not be affected by measurement protests lodged after the prize giving or such other time as the Sailing Instructions may prescribe. Nothing in this paragraph shall bar action under the RRS concerning a boat deliberately altered and shall not limit in any way acts of the Race and Protest Committees against any individual person involved.

306 National Prescriptions

National Authorities may by their national prescriptions change rules of Part 3 for national events under their jurisdiction. National events shall be considered those where entries are only from the host country.

4. SCORING

401 General

401.1 ORC Rating systems provide a variety of methods for calculating corrected times using the ratings calculated by the ORC VPP and displayed on the ORC International and ORC Club certificates. Selection of the scoring methods depends on the size, type and level of the fleet, type of the race, and local racing conditions and its use is at the discretion of National Authorities or local event organizers, except for the events governed by the ORC Championship Rules.

401.2 Corrected time shall be displayed in days:hours:minutes:seconds. When calculating corrected time, the boat's elapsed time shall be translated to seconds, calculations shall be made and results shall be then rounded to the nearest second (for example: 12345.5 = 12346 seconds). This time in seconds shall be then put back in days:hours:minutes:seconds format.

401.3 When calculating corrected time, the length of the course shall be recorded to a precision of 0.01 NM.

401.4 General Purpose Handicap (GPH) is an average representation of all time allowances used for simple comparisons between boats and possible class divisions. It is calculated as an average of the time allowances of 8 and 12 knots true wind speed for the Circular Random pre-selected course as defined in 402.4(b).

401.5 Class Division Length (CDL) is the average of the effective sailing length (IMS L) and the rated length (RL) that is calculated from the upwind speed of the boat in a True Wind Speed of 12 knots. It is used for class divisions as a combination of the boat's upwind speed and length.

402 Performance Curve Scoring

402.1 Performance Curve Scoring is the most powerful engine of the ORC International rating system. Its unique feature, making it fundamentally different and much more precise from any other handicap system, is its capacity to give and rate different handicaps for different race conditions because yachts do not have the same performance in different wind strengths and directions.

402.2 ORC International certificate provide a range of ratings (time allowances expressed in s/NM) for different wind conditions in the range of 6 – 20 knots of true wind speed from optimum beat, over 52, 60, 75, 90, 110, 120, 135, 150 degrees of true wind angle to the optimum run.

TIME ALLOWANCES							
Wind Velocity	6 kt	8 kt	10 kt	12 kt	14 kt	16 kt	20 kt
Beat VMG	749.7	625.1	559.6	535.4	522.6	508.6	497.8
52°	487.8	417.6	392.6	381.2	373.3	364.4	349.8
60°	457.4	404.0	378.2	364.1	355.1	348.0	329.8
75°	436.5	392.4	359.1	337.2	325.8	318.0	297.7
90°	441.4	394.9	362.1	328.3	305.7	293.6	278.1
110°	465.7	395.2	355.6	331.0	309.5	292.5	246.7
120°	482.6	401.5	357.9	322.2	300.5	281.8	244.6
135°	539.6	428.2	385.5	347.6	309.5	273.4	228.1
150°	648.0	508.3	433.2	388.8	359.7	325.8	256.8
Run VMG	748.2	587.0	500.2	451.3	415.3	376.2	296.5
Selected Courses							
Windward / Leeward	749.0	606.1	529.9	493.4	468.9	442.4	397.2
Circular Random	627.3	507.6	442.5	402.9	375.8	354.8	321.1
Coastal / Long Distance	748.9	570.3	477.5	422.4	389.4	358.2	304.3
Non Spinnaker	686.9	551.5	476.7	430.6	399.6	376.8	343.5

Figure 1 - Time allowances as printed on the ORC International Certificate

402.3 When calculating corrected time by the Performance Curve Scoring, a course to be sailed shall be taken as one of the pre-selected courses for which time allowances are given on the certificate, or constructed from the data measured at the racing area.

402.4 Pre-selected courses are:

a) **Windward/Leeward** (up and down) is a conventional course around windward and leeward marks where the race course consists of 50% upwind and 50% downwind legs.
b) **Circular Random** is a hypothetical course type in which the boat circumnavigates a circular island with the true wind direction held constant.
c) **Coastal / Long Distance** is a composite course, the content of which varies progressively with true wind angle as follows:

TWS (kt)	***6***	***8***	***10***	***12***	***14***	***16***	***20***
Beat VMG	45%	40%	35%	30%	25%	20%	10%
60°	0%	5%	10%	15%	17.5%	20%	25%
90°	0%	5%	7.5%	10%	12.5%	15%	20%
120°	0%	5%	10%	15%	17.5%	20%	25%
150°	0%	5%	10%	15%	15%	15%	10%
Run VMG	55%	40%	27.5%	15%	12.5%	10%	10%

d) **Non Spinnaker** is a circular random course type (see above), but calculated without the use of a spinnaker or any headsail set flying.

402.5 When the course is constructed the following data shall be taken for each leg: wind direction, length and direction of each leg, and optionally, the direction and rate of the current on each leg. Any leg can be split in sub-legs in case there is a marked shift in wind and/or current direction.

402.6 Percentage of each wind direction, corrected for the tide is calculated from the constructed course data.

402.7 For each course, a boat's performance curve is calculated using the course definition and time allowances given in the certificate.

402.8 The vertical axis represents the speed achieved in the race, expressed in seconds per mile. The horizontal axis represents the wind speed in knots *(Figure 2).* Elapsed time shall be divided by the distance of the course to determine the average speed in seconds per mile.

For that average speed a point on the performance curve shall be determined by interpolation and a respective average wind for that points shall be determined as "Implied Wind". If the "Implied Wind" point would fall outside of 6-20 knots of wind a respective 6 or 20 knots value shall be used.

"Implied Wind" is representing the boat's performance on that course. The faster the boat has sailed, the higher the "Implied Wind", which is the primary index for scoring.

402.9 The highest "Implied Wind" of the best boat in the race is then used as the wind speed for corrected times calculations. For that wind on the horizontal axis, the appropriate time allowances are determined on each boat's curve on the vertical axis. Such a time allowance is then used as a single number Time-on-Distance coefficient as defined in 403.2

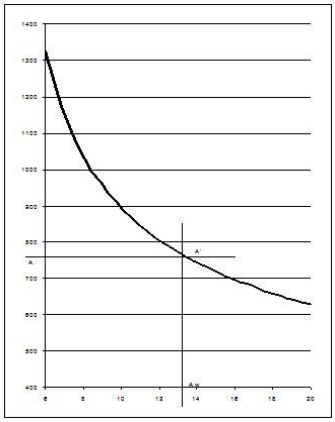

Figure 2: Performance Curve

402.10 An alternative to the method described in 409.9 is that results can be determined by the order from the highest to the lowest "Implied wind". In such a case corrected times are calculated from the performance curve of each boat by converting her "Implied wind" to a time allowance that is multiplied by the length of the course. Use of this method shall be specified in the Notice of Race and Sailing Instructions.

402.11 Race results can be re-scored after the race only if the winning boat is found not complying with her certificate according to Rules 303.6, 305.2(b) or (c). In that case, the implied wind of the best boat after re-calculation shall be used as the wind speed for corrected times calculations.

402.12 "Implied Wind" for the winning boat normally approximates the predominant wind strength for the race. However, in cases where the "Implied Wind" does not represent fairly the real wind strength during a race, the wind strength may be determined by the Race Committee.

402.13 All the formulas for course and performance construction and interpolations together with relevant code for the scoring software are available from ORC and scoring software may be downloaded at the ORC website (www.orc.org).

403 Simple scoring options

403.1 ORC International and ORC Club certificates are providing simple scoring options using the ratings determined as single or triple number. For any of the simple scoring options, ratings are given for the coastal/long distance and for the windward/leeward courses.

SCORING OPTIONS						
	COASTAL / LONG DISTANCE			WINDWARD / LEEWARD		
Time on Distance	443.3			503.7		
Time on Time	1.3534			1.3401		
Triple Number	Low	Medium	High	Low	Medium	High
Time on Distance	522.2	405.7	346.9	677.5	508.8	432.1
Time on Time	1.2926	1.6639	1.9457	0.9963	1.3266	1.5623

403.2 **Time On Distance**

Corrected time is calculated as follows:

*Corrected time = Elapsed time – (ToD_{Delta} * Distance)*

Where $ToD_{Delta} = ToD_{the\ boat} - ToD_{the\ lowest\ (fastest\ boat)\ in\ the\ fleet}$

where the corrected time of the boat having the fastest ToD in the fleet will be equal to her elapsed time.

The Coastal / Long Distance ToD coefficient is calculated as follows:

TWS (kt)	***8***	***12***	***16***
Beat VMG	40%	30%	20%
60°	5%	15%	20%
90°	5%	10%	15%
120°	5%	15%	20%
150°	5%	15%	15%
Run VMG	40%	15%	10%

The Windward/Leeward ToD coefficient is calculated as follows:

TWS (kt)	*8*	*12*	*16*
W/L course	25%	40%	35%

A custom-made ToD coefficient may be calculated using a different wind distribution matrix based on wind historical data or weather forecast for a particular race. Course model to be used shall be specified in the Notice of Race and Sailing Instructions.

With Time-on-Distance (ToD) scoring, the coefficient of time allowance of one boat will not change with wind velocity, but will change with length of the course. One boat will always be giving to another the same handicap in s/NM, and it is easy to calculate the difference in elapsed time between two boats needed to determine a winner in corrected time.

A special ToD coefficient calculated with an average crew weight of 170 kg is available for double handed racing as well as calculated without the use of a spinnaker or any headsail set flying.

403.3 Time On Time

Corrected time is calculated as follows:

*Corrected time = ToT * Elapsed time*

The Coastal / Long Distance ToT coefficient is calculated as 600 / $ToD_{coastal\ /\ long\ distance}$.

The Windward / Leeward ToD coefficient is calculated as 675 / $ToD_{windward\ /\ leeward}$.

A custom made ToT coefficient may be calculated using conversion factor to the custom made ToD coefficient calculated as in 403.2. A conversion factor may be set as ToD representing the middle of the fleet. Use of different correction factor will not change the place in corrected times, it will only affect the differences in corrected time.

With Time-On-Time (ToT) scoring, time allowances will increase progressively through the duration of the race. Course distance has no effect on the results and need not be measured. Corrected time will depend only on the elapsed time, and the difference between boats may be seen in seconds depending of the duration of the races. The longer the race, the larger the handicap.

A special ToT coefficient calculated with an average crew weight of 170 kg is available for double handed racing as well as calculated without the use of a spinnaker or any headsail set flying.

403.4 Triple Number

Triple number ToD coefficients are calculated as follows:

TWS (kt)	*6*	*8*	*10*	*12*	*14*	*16*	*20*
Low	50%	50%					
Medium		8.4 %	33.3%	33.3%	25%		
High					25%	37.5%	37.5%

Coastal / Long Distance Triple number ToD coefficients are calculated using time allowances for the Circular Random type of pre-selected course.

Coastal / Long Distance Triple number ToT coefficients are calculated as 675 / $ToD_{coastal\ /\ long\ distance}$.

Windward / Leeward Triple number ToD coefficients are calculated using time allowances for the Windward / Leeward type of pre-selected course.

Windward / Leeward Triple number ToT coefficient is calculated as 675 / $ToD_{windward\ /\ leeward}$.

The Triple Number system provides a set of three time ToD or ToT coefficients given for three wind ranges:

- Low Range (less or equal 9 knots)
- Medium Range (between 9 & 14 knots)
- High Range (greater or equal 14 knots)

The Race Committee shall signal before the start the wind range to be used for scoring, but it may change this in case of significant change in the weather conditions.

ORC INTERNATIONAL CERTIFICATE SAMPLE

BOAT		GPH
Name	MASCALZONE LATINO	455.2
Sail Nr	ITA-14909	

GENERAL	
Class	COOKSON 50 CANT
Designer	FARR
Builder	COOKSON
Series	11.2004
Age	04.2005
Age Allowance	0.455%
Offset File	I14909N.off - 30.6.2017. 8:59:41
Measurement by	NOC-MUZZI-SIRONI - 26.06.2017

HULL					
Length Overall	15.220m				
Maximum Beam	4.252m				
Displacement	7,483kg				
Draft	3.276m				
IMS Reg. Division	Performance				
Dynamic Allowance	0.000%				
Fwd Accommodation	Yes				
Hull Construction	Carbon				
Carbon Rudder	Yes				
Crew Arm Extension					
IMSL	14.330m	VCGD	-0.585m	Sink	30.40kg/mm
RL	15.554m	VCGM	-0.595m	WS	38.89m²
LSM0	13.987m	Displacement/Length ratio			2.7347

ORC
World Leader in Rating Technology

2018
ORC International Certificate

Rating Office

Space for Rating Office address and logo

SCORING OPTIONS

	COASTAL / LONG DISTANCE			WINDWARD / LEEWARD		
Time on Distance	443.3			503.7		
Time on Time	1.3534			1.3401		
Triple Number	Low	Medium	High	Low	Medium	High
Time on Distance	522.2	405.7	346.9	677.5	508.8	432.1
Time on Time	1.2926	1.6639	1.9457	0.9963	1.3266	1.5623

TIME ALLOWANCES

Wind Velocity	6 kt	8 kt	10 kt	12 kt	14 kt	16 kt	20 kt
Beat VMG	749.7	625.1	559.6	535.4	522.6	508.6	497.8
52°	487.8	417.6	392.6	381.2	373.3	364.4	349.8
60°	457.4	404.0	378.2	364.1	355.1	348.0	329.8
75°	436.5	392.4	359.1	337.2	325.8	318.0	297.7
90°	441.4	394.9	362.1	328.3	305.7	293.6	278.1
110°	465.7	395.2	355.6	331.0	309.5	292.5	246.7
120°	482.6	401.5	357.9	322.2	300.5	281.8	244.6
135°	539.6	428.2	385.5	347.6	309.5	273.4	228.1
150°	648.0	508.3	433.2	388.8	359.7	325.8	256.8
Run VMG	748.2	587.0	500.2	451.3	415.3	376.2	296.5
Selected Courses							
Windward / Leeward	749.0	606.1	529.9	493.4	468.9	442.4	397.2
Circular Random	627.3	507.6	442.5	402.9	375.8	354.8	321.1
Coastal / Long Distance	748.9	570.3	477.5	422.4	389.4	358.2	304.3
Non Spinnaker	686.9	551.5	476.7	430.6	399.6	376.8	343.5

Velocity Prediction in Knots for True Wind Speeds

Wind Velocity	6 kt	8 kt	10 kt	12 kt	14 kt	16 kt	20 kt
Beat Angles	43.2°	42.7°	39.0°	37.3°	36.4°	35.5°	34.9°
Beat VMG	4.80	5.76	6.43	6.72	6.89	7.08	7.23
52°	7.38	8.62	9.17	9.44	9.64	9.88	10.29
60°	7.87	8.91	9.52	9.89	10.14	10.34	10.92
75°	8.25	9.17	10.02	10.68	11.05	11.32	12.09
90°	8.16	9.12	9.94	10.96	11.78	12.26	12.94
110°	7.73	9.11	10.12	10.88	11.63	12.31	14.60
120°	7.46	8.97	10.06	11.17	11.98	12.77	14.72
135°	6.67	8.41	9.34	10.36	11.63	13.17	15.78
150°	5.56	7.08	8.31	9.26	10.01	11.05	14.02
Run VMG	4.81	6.13	7.20	7.98	8.67	9.57	12.14
Gybe Angles	141.2°	141.5°	147.7°	152.5°	149.5°	146.0°	140.0°

Certificate
Number 149091
ORC Ref ORC00079617
Issued On 5.1.2018.
VPP Ver. 2018 1.00
Valid until 31.12.2018.

Crew Weight

Default	1,111kg
Maximum	970kg
Minimum*	728kg

*when applied by the NoR and SI
Non Manual Pwr Sheets

Special Scoring

	ToD	ToT
Non Spin GPH	491.1	1.2217
Non Spin OSN	481.7	1.2455

Sails Limitations

Headsails	Spinnakers
7	5

Class Division Length
CDL = 14.943

Storm Sails Areas

Heavy Weather Jib	56.96
Storm Jib (JL=13.35)	21.09
Storm Trysail	24.83

Owner

I certify that I understand my responsibilities under ORC Rules and Regulations

Signature

BOAT

Name	MASCALZONE	Sail Nr	ITA-14909
File	I14909 for rules	Data in	meters/kilograms

RIG

Forestay Tension	Aft	Spreaders	3
Inner Stay	None Fitted	Runners	0
Carbon Mast	Yes	Jumper Struts	None
Taper Hollows	No	Jib Furler	No
Fiber Rigging	Yes	Main Furler	No
Lenticular Rigging	No	Without Backstay	No
Articulated Bowsprit	No		

P	20.710	E	6.850	MDT1	0.128	MW	0.290
IG	20.540	J	6.140	MDL1	0.297	GO	0.290
ISP	22.970	SFJ	0.000	MDT2	0.107	BD	0.355
BAS	1.910	SPL	0.000	MDL2	0.214	MWT	243.80
FSP	0.088	TPS	8.000	TL	1.750	MCG	7.812

MIZZEN RIG AND SAILS

N/A

COMMENTS

INCLINING TEST AND FREEBOARDS

Inclining Test **Current Inclining**

Flotation date **18.06.2017** SG **1.0250**

FFM	0.302	FF	0.301	SFFP	0.140
FAM	0.820	FA	0.823	SAFP	15.227
W1	143.7	PD1	495.9	WD	14.350
W2	143.7	PD2	494.4	GSA	1.0
W3	143.7	PD3	495.5	RSA	1.0
W4	143.7	PD4	497.9	PLM	9000.0

LCF from stem on CL / on sheer	8.287 / 8.541
Maximum beam station from stem	9.568
RM Measured	327.5kg·m
RM Default	218.6kg·m
Limit of positive stability / Stab.Index	119.7° / 119.7
Freeboard at mast at 6.140	1.356

PROPELLER

Installation	Strut			PRD	0.457
Type	Folding 2 blades			PBW	0.115
Twin Screw	No			PIPA	0.0039
ST1	0.048	ST3	0.180	ST5	0.280
ST2	0.180	ST4	0.112	EDL	2.240

MOVABLE BALLAST

Keel Angle	40.0
List Angle	15.5
BLR Index	1.0806

BILGEBOARD

BS	2.330	BT	0.058	BA	0.0
BF	0.210	BX	5.576		
BC	0.431	BY	0.000		

ORC
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2018
IMS Measurement Certificate

Certificate

Number **149091**
ORC Ref **ORC00079617**
Issued On **5.1.2018.**
VPP Ver. **2018 1.00**
Valid until **31.12.2018.**

Space for Rating Office logo

SAILS (Maximum Areas)

Mainsail	MHB	MUW	MTW	MHW	MQW	Area	Area (r)	Formula
	1.360	2.04	2.94	4.40	5.73	88.64	90.36	P/8 · (E + 2·MQW+ 2·MHW + 1.5·MTW + MUW + 0.5·MHB)

Symmetric
Not Available

Asymmetric	SLU	SLE	SL	SHW	SFL			
	25.10	21.22	23.16	12.90	12.88	248.89		AS · (SFL + 4·SHW) / 6

HEADSAILS

Area = 0.1125·HLU · (1.445·HLP + 2·HQW + 2·HHW + 1.5·HTW + HUW + 0.5·HHB)

HHB	HUW	HTW	HHW	HQW	HLP	HLU	Area	Btn	Fly	Meas.Date	Material	Comment
0.12	1.01	1.85	3.35	4.78	6.17	20.55	67.09	N	N	22.06.2017	Unknow	J1
0.14	0.99	1.83	3.32	4.71	6.18	20.64	66.86	N	N	08.06.2016	Carbon	
0.12	0.87	1.64	3.21	0.00	6.28	20.59	65.70	N	Y	07.10.2016	Unknow	
0.13	0.95	1.73	3.21	4.70	6.13	20.64	65.68	N	N	08.06.2016	Carbon	
0.13	0.96	1.76	3.19	4.67	6.12	20.55	65.26	N	N	22.06.2017	Unknow	J2
0.10	0.78	1.47	2.85	4.32	5.83	20.30	58.92	N	N	08.06.2016	Unknow	

MEASUREMENT INVENTORY

Measurer **MUZZI 66**
Date **18.06.2017**
Comment **PORTOFERRAIO**

Id	Item	Weight	Distance	VCG	Description

Id	Item	Maker	Model
A	Engine	YANMHAR	54 HP

Id	Item	Weight	Description

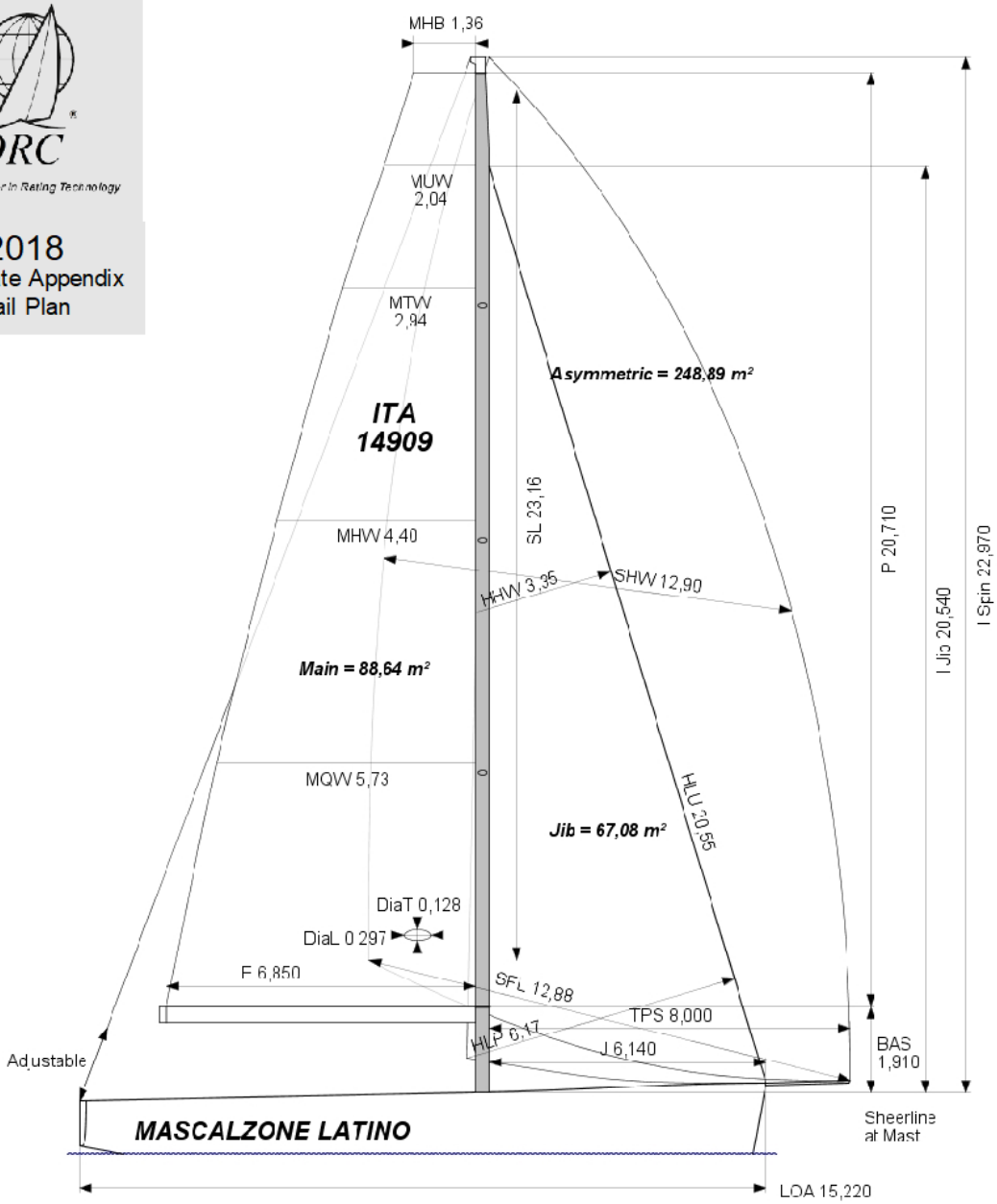
MEASUREMENT INVENTORY

Id	Item	Tank Use	Tank Type	Capcty	Dist.	VCG	Condtn	Description
A	Tank	GASOLIO	PVC	160.0	12.00	0.00	~~25.0~~	LT
B	Tank	ACQUA	PVC	400.0	11.07	0.00	~~0.0~~	VUOTO

Id	Item	Weight	Distance	VCG	Description
A	Battery	50.0	7.10	0.00	300 Ah

ORC
World Leader in Rating Technology

2018
Certificate Appendix
Sail Plan



SAILS INVENTORY

MAIN SAIL (1)

Id	MHB	MUW	MTW	MHW	MQW	Area	Measurer	Meas.Date	Manufacture	Material	Comment
E	1.360	2.04	2.94	4.40	5.73	88.64	SIRONI	26.06.2017	MILLENIUM	Unknown	

HEAD SAILS (6)

Id	HHB	HUW	HTW	HHW	HQW	HLP	HLU	Ovrlp	Area	Btn	Fly	Measurer	Meas.Date	Manufacture	Material	Comment
i	0.12	1.01	1.85	3.35	4.78	6.17	20.55	100%	67.09	N	N	MUZZI	22.06.2017	MILLENNIU	Unknow	J1
E	0.14	0.99	1.83	3.32	4.71	6.18	20.64	101%	66.86	N	N	NOCETI	08.06.2016	MILLENIUM	Carbon	
H	0.12	0.87	1.64	3.21	0.00	6.28	20.59	102%	65.70	N	Y	MUZZI	07.10.2016		Unknow	
F	0.13	0.95	1.73	3.21	4.70	6.13	20.64	100%	65.68	N	N	NOCETI	08.06.2016	MILLENIUM	Carbon	
H	0.13	0.96	1.76	3.19	4.67	6.12	20.55	100%	65.26	N	N	MUZZI	22.06.2017	MILLENNIU	Unknow	J2
G	0.10	0.78	1.47	2.85	4.32	5.83	20.30	95%	58.92	N	N	NOCETI	08.06.2016	MILLENIUM	Unknow	

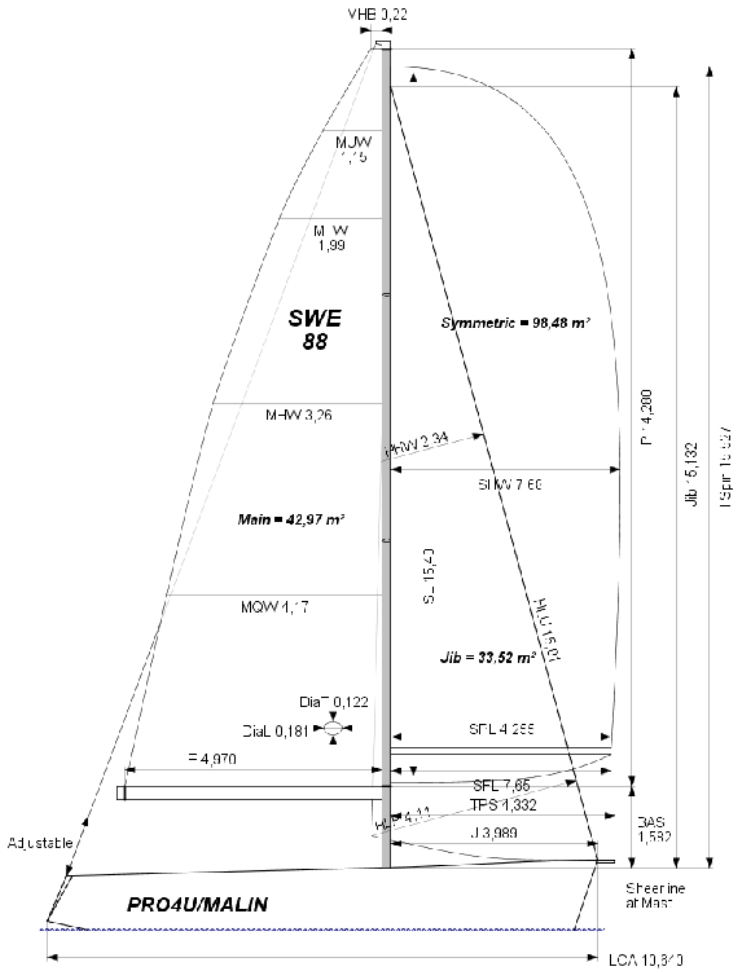
SYMMETRIC SPINNAKERS (0)

Id	SLU	SLE	SL	SHW	SFL	Area	Measurer	Meas.Date	Manufacture	Material	Comment

ASYMMETRIC SPINNAKERS (1)

Id	SLU	SLE	SL	SHW	SFL	Area	Kind	Measurer	Meas.Date	Manufacture	Material	Comment
L	25.10	21.22	23.16	12.90	12.88	248.89	asym	MUZZI	09.10.2016		Unknown	

ORC CLUB CERTIFICATE SAMPLE



ORC
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2017
ORC Club Certificate

Rating Office

Space for Rating Office address and logo

Certificate

Number **5841**
Issued On **5.1.2018.**
ORC Ref **ORC00079616**
VPP Ver. **2017 1.00**
Valid until **31.12.2017.**

Crew Weight

Default	647kg
Maximum	**649kg**
Minimum*	**487kg**

**when applied by the NoR and SI*

Non Manual Pwr **No**

Special Scoring

	ToD	ToT
Non Spin GPH	**651.2**	**0.9214**
Non Spin OSN	**632.9**	**0.9480**

Sails Limitations

Headsails **5** Spinnakers **3**

Spinnaker configuration

Symmetric: **Yes** **98.48**
Asymmetric: **No**
Flying H/S: **No**
Spin. Pole: **Yes**

Class Division Length

CDL = **9.122**

Stability (Measured)

Limit Positive Stab.: **118.5°**
Stability Index: **120.7**

Owner

I certify that I understand my responsibilities under ORC Rules and Regulations

Signature

BOAT

Name **Pro4u/Malin**
Sail Nr **SWE 88**

GPH

620.8

CLASS

Class	**FIRST 36,7 MOD**
Designer	**FARR YACHT DESIGN**
Builder	**BENETEAU**
Series	**09.2001**
Age Date	**06.2002**
Age Allowance	**0.487%**

COMMENTS

HULL

Data File	**5841 for rule**	LOA	**10.640m**
Offset File	**F196MOD_RUD_**	MB	**3.458m**
Displacement	**5,760kg**	Draft	**2.236m**
IMS Division	**Cruiser/Racer**	Dynamic All.	**0.049%**
Fwd Accom.	**Yes**	Construction	**Solid**
Fiber Rigging	**No**	Aramid Core	**No**
Crew Arm Ex		Carbon Rudder	**Yes**
		Light Stanchions	**No**

IMSL	**9.621m**	VCGD	**0.043m**	Sink	**19.45kg/mm**
RL	**8.622m**	VCGM	**0.024m**	WS	**25.72m²**
LSM0	**9.576m**	Displacement/Length ratio			**6.5595**

Water Ballast **0** Trim Tab **No**
BLR Index **0.0000**

PROPELLER

Installation **Strut**
Type **Folding 2 blades**

PRD **0.406**
PBW **0.120**
PIPA **0.0031**

CENTERBOARD

N/A

SCORING OPTIONS

	COASTAL / LONG DISTANCE			WINDWARD / LEEWARD		
Time on Distance	**604.4**			**673.0**		
Time on Time	**0.9927**			**1.0030**		
Triple Number	Low	Medium	High	Low	Medium	High
Time on Distance	**707.8**	**551.1**	**492.7**	**913.6**	**676.1**	**586.4**
Time on Time	**0.9537**	**1.2249**	**1.3699**	**0.7388**	**0.9984**	**1.1510**

INDEX OF SYMBOLS

AA	Age Allowance	103.1
B	Effective Beam	100.7
BLRI	Ballast Leeward Recovery Index	106.4
BTR	Beam Depth Ratio	100.9
CDL	Class Division Length	401.5
CI	Capsize Increment	106.2
CW	Crew Weight	102
DA	Dynamic Allowance	103.2
DSPM	Displacement in Measurement Trim	100.5
DSPS	Displacement in Sailing Trim	100.5
FA	Freeboard Aft (for default SG)	100.2
FF	Freeboard Forward (for default SG)	100.2
GPH	General Purpose Handicap	401.4
MHBI	Height of Base of I	100.4
IM	Foretriangle Height	108.5
IMS L	Sailing Length	100.6
LPS	Limit of Positive Stability	106.1
LSM0-4	Second Moment Lengths	100.6
PIPA	Propeller Installation Projected Area	105.1
RA90	Righting Arm, 90 degrees	106.4
RM	Righting Moment	107
RMC	Righting Moment Corrected	107.3
SI	Size Increment	106.2
T	Effective Hull Depth	100.8
VCGD	Vertical Centre of Gravity from the offset datum line	100.10
VCGM	Vertical Centre of Gravity from the measurement trim waterline	100.11