

OFFSHORE RACING CONGRESS

World Leader in Rating Technology



ORC SY MEASUREMENT GUIDANCE 2017

1. INTRODUCTION

This paper must be taken as guidance for the process of boat measurement to allow for the issuance of an ORC SY certificate. These measurement procedures will be included in the ORC SY rule to be issued soon. This protocol tries to address issues related to the measurement of large SuperYachts:

- a) The need of an accurate DSPL measurement (as close as possible to racing trim)
- b) The need for an accurate stability measurement
- c) Any request to include in the racing trim the “cruising gear” kept on board during SuperYacht races.
- d) The possibility to make measurement controls during the racing events.

This protocol could be amended during the season to address possible issues which may arise when measuring SuperYachts.

2. DSPL CALCULATION

The RACING TRIM (and VCG) could be computed in two ways (listed in decreasing level of accuracy):

- FULL MEASUREMENT with Offset File and Freeboards measurement compulsory
- DECLARED MEASUREMENT + STABILITY BOOKLET used for almost all boats during 2015 season and with no need of measuring freeboards and scan the boat

2.1 Full Measurement (offset scanned and freeboards measured)

This is the sequence of the operations to be performed to obtain a full measurement:

2.1.1 Offset file scanned with laser machine (Total Station or 3D photogrammetry scanner) made with an official measurer appointed by ORC

The yacht shall be presented for measurement ashore in an accessible location, clear of obstructions, properly and firmly chocked and leveled athwartships and approximately in the same longitudinal trim which it might reasonably be expected to assume when afloat in measurement trim. A centerboard, if any, shall be in its maximum raised position. A centerboard that can be locked to prevent movement while racing, shall be in its locked position and measured as a keel. Rigging shall be slack. All appendages shall be fitted and any fairings shall be in place.

Once a hull is completely measured, an OFF file shall be generated using ORC-approved software by the Rating Authority or if needed by the ORC Chief Measurer. The OFF file shall be accompanied with relevant documentation such as photos of freeboard sheer points or diagrams describing complete hull, appendages or other details. Where a number of hulls of the same model

are built using the same moulds for the hull, keel and rudder, a standard OFF file for that model will be created and no hull measurement will be needed for other boats built from the same mould.

2.1.2 Freeboard Measurement in the water made with an official measurer appointed by ORC

A yacht shall be measured in a measurement trim as defined in IMS Rule B4. Items listed in B4.2 when impracticable to be removed from the boat may remain aboard with their weight and longitudinal and vertical position recorded.

Centerboards should be kept in the UP position and drawings with weight and stroke shall be provided. Lifting keels should be kept in their DOWN position. If the lifting keel (for depth problems) will be kept in the UP position drawings with weight and stroke shall be provided.

Before measuring the floatation, the captains and crew should unload as more as possible the weights that won't be on board during the race (apart from liquids that will be recorded). Items such as drinkable water, spirits, clothes, and personal items should be unloaded if possible during measurement.

A detailed inventory list of what is on board when measuring MUST be prepared by the measurer, including the weight, LCG and VCG of each item. (In par. 9 is a suggested method using an Excel Spreadsheet and a plot).

The captain should declare which items will be kept on board during racing, and which items are removed, the final inventory list will be copied in the certificate and kept on board, together with the certificate (this inventory list will be checked during the races). If the boat will be not exactly in the lightship trim, the inventory list will enable the same the VPP to compute both LIGHTSHIP and SAILING trim displacements.

The lightship trim will be computed from measured displacement, deducting all the weights on board during the measurement contained in the inventory list. The racing trim will be then computed from lightship displacement adding:

- All the important and recognizable weights that will be declared ON BOARD WHILE RACING
- The declared liquids on board when racing
- The declared anchors and chain
- Default crew weight

The default crew weight is calculated as:

$$\text{creweight} = \text{ORC_DEF_CW} \cdot \text{cw}_{\text{mult}}$$

with

$$\text{ORC_DEF_CW} = 25.8 \cdot \text{LSM0}^{1.4262}$$

$$\text{cw}_{\text{mult}} = 1.0625 - 0.00125 \text{ DSP0}/1000$$

DSP0 is the lightship displacement.

The factor cw_{mult} is bounded in the range [0.3 , 1.0].

- Default Racing gear weight (16% of the *ORC_DEF_CW*)
- Default sails weight

$$\text{mainsail} = 0.1709 \cdot \text{LSM0}^{2.1821}$$

$\text{headsail} = 0.0677 \cdot (\text{LSM0})^{2.3493}$ - multiplied by the declared number of headsails (max 3 will be accounted)

$\text{spinnaker} = 0.1426 \cdot (\text{LSM0})^{2.0568}$ - multiplied by the declared number of spinnaker (max 3 will be accounted)

2.1.3 Stability Measurement from inclining using the boom as extension arm (one degree of heel minimum should be reached).

The inclining test shall be performed as follows:

- a) The boat shall be in measurement trim as defined above.
- b) The boom shall be placed outboard and fixed with its end in the longitudinal position of:
 - the LCF (longitudinal centre of flotation) when known from the stem; or
 - when LCF is not known, at the **MB** station (**SMB** from the stem), but not aft of 65% **LOA**.
- c) Heel angle without weights shall be recorded either with a manometer or an ORC-approved electronic inclinometer.
- d) Weights shall be suspended on the end of the boom and resulting angle recorded again either with a manometer or an ORC-approved electronic inclinometer.
- e) Same procedure in iii. and iv. shall be repeated on port and starboard sides, averaging the results

2.2 DECLARED MEASUREMENT (with no need of measuring freeboards)

- a) DESIGNER OFFSET FILE or 3D HULL FILE (IGES or STP or other tridimensional file) provided by designer or shipyard
- b) Official STABILITY BOOKLET
- c) LIGHTSHIP DSPL FROM STABILITY BOOKLET
- d) Stability derived from the STABILITY BOOKLET

As the boats should be rated in their RACING TRIM, hence starting from LIGHTSHIP TRIM (empty), the following additions will be made:

1. Default Crew weight

The default crew weight is calculated as:

$$\text{creweight} = \text{ORC_DEF_CW} \cdot \text{cw}_{\text{mult}}$$

With

$$\text{ORC_DEF_CW} = 25.8 \cdot \text{LSM}^{1.4262}$$

$$\text{cw}_{\text{mult}} = 1.0625 - 0.00125 \text{ DSP0}/1000$$

DSP0 is the lightship displacement.

The factor cw_{mult} is bounded in the range [0.3 , 1.0].

2. Default Racing gear weight (16% of the *ORC_DEF_CW*)

3. Default Sails weight

$$\text{mainsail} = 0.1709 \cdot \text{LSM}^{2.1821}$$

$$\text{headsail} = 0.0677 \cdot (\text{LSM})^{2.3493}$$

$$\text{spinnaker} = 0.1426 \cdot (\text{LSM})^{2.0568}$$

4. Declared Liquids

5. The declared anchors and chain

Crew and sails are computed by default by the VPP, and liquids and anchors are declared by the captains before the races.

WARNING:

The default evaluation of the above weights to be added to lightship DSPL will be underestimated compared to real ones and the Righting Moment taken from Stability Booklet will be increased by 5% to not unduly favor boats not completely measured

3. TANKS

Tank volumes and positions will be derived from the following documentation:

- STABILITY BOOKLET
- DRAWING WITH CAPACITIES/LCG/VCG

4. SUPERSTRUCTURE GEOMETRY

The ORC Rating Office will derive superstructure geometry areas from SAILPLAN and DECKPLAN drawings.

5. CENTERBOARDS

The ORC Rating Office will derive centerboard geometry from CENTERBOARD drawings.

6. DECLARED VALUES

This is a list of declared values that Captains/owners/designers/Shipyards should declare:

- DOME DIMENSIONS
- SAILS IN THE INVENTORY COUNT
- FURLED MAIN/JIB
- SAILS ON A FURLER UPWIND
- FURLING UPWIND SAILS WHEN TACKING
- RIG CONFIG (Sloop / Ketch / Schooner etc.)
- CONSTRUCTION MATERIALS
- TANK LEVELS
- ANCHORS
- WINCH CHARACTERISTICS (KW and SPEED)

7. DRAWINGS AND DOCUMENTATION TO BE PROVIDED

The following drawings (in AUTOCAD format) and documentation should be provided:

- TANKS PLAN
- SAIL PLAN
- DECK PLAN WITH SIDE AND FRONTAL LINES OF THE COACHROOF
- CENTERBOARD PLAN
- STABILITY BOOKLET
- PROPELLER INSTALLATION

8. CONTROLS DURING RACES

Floataion controls during races are tricky, yet could be performed with loose mooring lines in calm waters and making a clear photo of the boat conditions during measurement to be compared with certificate conditions.

There are two different ways of checking floataion:

- If the certificate has been issued with freeboard measurements by checking the same freeboards in the same position
- If no floataion has been performed before, it is necessary that immersion marks should be present on the hull (not many boats have these). With the Stability Booklet it is easy to check the displacement

The only controls that could be performed during races without too many problems are the checking of inventory lists, liquids, etc.

9. INVENTORY LIST EXAMPLE

The measurer will compile a detailed inventory list of what is on board when measuring. It will be possibly made on an EXCEL spreadsheet including the weight, LCG and VCG of each item. (here below is a suggested format).

The captain should declare which items will be kept on board during racing, and which items are removed, the final inventory list will be copied in the certificate and kept on board, together with the certificate (this inventory list will be checked during the races). The reference of coordinates X and Z for the inventory will be the bow and the floatation WL (or any other horizontal reference that the measurer will clearly communicate to ORC). The inventory will be separated in different sections:

- General items
- Anchors and chain
- Sails
- Liquids

BOAT **NAME**

LOA 40.645

WEIGHTS ON BOARD DURING MEASUREMENT				DATUM	DATUM	
Item	Quant	Kgs	total	X	Z	CARRIED ON BOARD WHILE RACING
Fwd Bilge	1	99	99	8.10	-0.5	
Crew cabins	1	316	316	8.10	0.1	
Crew mess fwd	1	285	285	10.30	-0.5	
Galley	1	92.8	92.8	13.20	0	
Pantry (Crew area)	1	3	3	14.40	0	
Lower salon	1	305	305	18.20	-0.2	
Lower salon (port)	1	137	137	18.20	-0.3	
Pilot house	1	160	160	22.70	2.3	
Engine room	1	194	194	23.00	-0.5	
Engin spares	1	319	319	24.00	-0.3	YES
Master cabin	1	793.5	793.5	25.00	0	
Port guest cabin	1	19.5	19.5	25.20	-0.4	
Stb guest cabin	1	59.5	59.5	25.20	-0.4	
Guest corridor	1	27	27	25.00	-0.5	
Main cockpit	1	269	269	28.50	2.6	
Aft cockpit	1	90	90	35.70	1	
GYM GEAR	1	253	253	39.70	1	YES
Port side deck	1	410	410	26.30	0.2	
Stb deck	1	483	483	26.30	0.2	
Forepeak lines	1	300	300	4.60	1.4	
People on board	6	80	480	23.00	2	
Tender	1	1300	1300	11.70	3	YES
TOTAL			6395	19.69	1.00	

				DATUM	DATUM	
	Quant	Kgs	total	X	Z	
Anchors	2	200	400	1.50	2.6	YES
Chains	2	1120	2240	5.80	0.2	YES

				DATUM	DATUM	
SAILS	Quant	Kgs	total	X	Z	
A0	1	130		8.90	3	YES
Mizzen staysail	1	70		4.60	3	YES
Mainsail	1	314		20.00	4.95	YES
Mizzen	1	95		34.00	4.9	YES
Staysail	1	75		9.00	7.5	YES
Genoa	1	320		5.60	17	YES

						DATUM	DATUM
	level during measurement	TOTAL VOLUME	Volume during measurement	sp w	mass (kg) during measurement	X	Z
1. Fuel fwd (P)	18.5%	6400	1184	0.84	995	19.59	-0.46
2. Fuel fwd (S)	41.0%	6000	2460	0.84	2066	19.59	-0.46
3. Fuel mid (P)	0.0%	2325	0	0.84	0	22.53	-1.26
4. Fuel mid (S)	0.0%	2325	0	0.84	0	22.53	-1.26
5. Fuel aft (P)	0.0%	1400	0	0.84	0	24.88	-1.20
6. Fuel aft (S)	0.0%	1400	0	0.84	0	24.88	-1.20
7. Day Tank	67.0%	400	268	0.84	225	21.05	-0.46
8. Fresh Water fwd (P)	29.0%	1405	407	1.00	407	16.50	-0.39
9. Fresh Water fwd (S)	64.0%	1405	899	1.00	899	16.50	-0.39
10. Fresh Water AFT (P)	28.0%	1450	406	1.00	406	27.65	-0.70
11. Fresh Water AFT (S)	28.0%	1450	406	1.00	406	27.65	-0.70