Scantling calculation report

Reference standard: ISO 12215-5:2019 + ISO 12215-7:2020 **Generated:** 2026-08-26 18:25

> **IMPORTANT NOTICE — READ BEFORE USING THIS DOCUMENT** > > This document is a **technical calculation report** generated by the AF Escantillonado software from the "Method 1 (Simplified)" of ISO 12215-5:2019 (and, where applicable, ISO 12215-7:2020 for multihulls), using the data entered by the user. Every formula in the calculation engine cites, in its source code, the exact table or clause of the standard it comes from, so the calculation is traceable and auditable. > > **This software is NOT a Notified Body nor a classification society, and this document does NOT by itself constitute a CE / RCD 2013/53/EU certificate.** Obtaining certification for a recreational craft requires, depending on the design category: > > - Categories C and D: self-certification by the manufacturer (module A), supported by technical documentation such as this one. > - Categories A and B (and certain B/C depending on length): mandatory involvement of a Notified Body. > > The manufacturer/designer remains solely responsible for verifying that the input data is correct, that the simplified method is applicable to their specific design (see limitations at the end of this document), and for the final adequacy of the scantlings. Review by a chartered naval architect before submitting this document to a Notified Body or authority is recommended.

> **MULTIHULL** > > This project is a catamaran. Design pressures were calculated per ISO 12215-7:2020 (Tables 5 to 8) combined with ISO 12215-5:2019 for the local scantlings of panels and stiffeners, as specified by ISO 12215-7 itself. Also review the limitations notice (section 5).

1. General boat data

- Design category: **C** (kDC (category factor, Table 6) = 0.60)
- Propulsion: **motor**
- Hull type: **catamaran**
- LH = 10.60 m, LWL = 9.86 m, BH = 1.15 m, Dmax = 1.60 m, TC = 0.55 m
- MLDC = 5800 kg, VN = 18.0 kn, BETA04 = 20.0 deg

2. Hull, deck and superstructure panels

12 elements — 12 pass, 0 FAIL

ID	Zone	Design P (kN/m2)	req. t/W	actual t/W	Util.	Status
FONDO-POPA	bottom	15.80	4.45 mm	4.50 mm	101%	OK
COSTADO-EXT-POPA	side	11.30	3.76 mm	4.00 mm	106%	OK
CUBIERTA-POPA	deck	5.00	2.50 mm	3.00 mm	120%	OK
FONDO-MEDIA	bottom	30.69	6.20 mm	6.50 mm	105%	OK
COSTADO-EXT-MEDIA	side	22.51	5.31 mm	5.50 mm	104%	OK
CUBIERTA-MEDIA	deck	7.24	3.01 mm	3.50 mm	116%	OK
FONDO-PROA	bottom	35.65	6.68 mm	7.00 mm	105%	OK
COSTADO-EXT-PROA	side	27.64	5.89 mm	6.00 mm	102%	OK
CUBIERTA-PROA	deck	9.17	3.39 mm	3.50 mm	103%	OK
COSTADO-INT-MEDIA	side	14.82	4.31 mm	4.50 mm	104%	OK
CUBMOJADA-POPAMEDIA	wetdeck	10.41	3.61 mm	4.00 mm	111%	OK

ID	Zone	Design P (kN/m2)	req. t/W	actual t/W	Util.	Status
CUBMOJADA-MEDIAPROA	wetdeck	13.10	4.05 mm	4.50 mm	111%	OK

Detail:

- **FONDO-POPA**: Panel FONDO-POPA (bottom): p_d=15.8 kN/m2; espesor real=4.50 mm, minimo exigido=4.45 mm (sigma_d=42.8 MPa) -> OK.
- **COSTADO-EXT-POPA**: Panel COSTADO-EXT-POPA (side): p_d=11.3 kN/m2; espesor real=4.00 mm, minimo exigido=3.76 mm (sigma_d=42.8 MPa) -> OK.
- **CUBIERTA-POPA**: Panel CUBIERTA-POPA (deck): p_d=5.0 kN/m2; espesor real=3.00 mm, minimo exigido=2.50 mm (sigma_d=42.8 MPa) -> OK.
- **FONDO-MEDIA**: Panel FONDO-MEDIA (bottom): p_d=30.7 kN/m2; espesor real=6.50 mm, minimo exigido=6.20 mm (sigma_d=42.8 MPa) -> OK.
- **COSTADO-EXT-MEDIA**: Panel COSTADO-EXT-MEDIA (side): p_d=22.5 kN/m2; espesor real=5.50 mm, minimo exigido=5.31 mm (sigma_d=42.8 MPa) -> OK.
- **CUBIERTA-MEDIA**: Panel CUBIERTA-MEDIA (deck): p_d=7.2 kN/m2; espesor real=3.50 mm, minimo exigido=3.01 mm (sigma_d=42.8 MPa) -> OK.
- **FONDO-PROA**: Panel FONDO-PROA (bottom): p_d=35.7 kN/m2; espesor real=7.00 mm, minimo exigido=6.68 mm (sigma_d=42.8 MPa) -> OK.
- **COSTADO-EXT-PROA**: Panel COSTADO-EXT-PROA (side): p_d=27.6 kN/m2; espesor real=6.00 mm, minimo exigido=5.89 mm (sigma_d=42.8 MPa) -> OK.
- **CUBIERTA-PROA**: Panel CUBIERTA-PROA (deck): p_d=9.2 kN/m2; espesor real=3.50 mm, minimo exigido=3.39 mm (sigma_d=42.8 MPa) -> OK.
- **COSTADO-INT-MEDIA**: Panel COSTADO-INT-MEDIA (side): p_d=14.8 kN/m2; espesor real=4.50 mm, minimo exigido=4.31 mm (sigma_d=42.8 MPa) -> OK.
- **CUBMOJADA-POPAMEDIA**: Panel CUBMOJADA-POPAMEDIA (wetdeck): p_d=10.4 kN/m2; espesor real=4.00 mm, minimo exigido=3.61 mm (sigma_d=42.8 MPa) -> OK.
- **CUBMOJADA-MEDIAPROA**: Panel CUBMOJADA-MEDIAPROA (wetdeck): p_d=13.1 kN/m2; espesor real=4.50 mm, minimo exigido=4.05 mm (sigma_d=42.8 MPa) -> OK.

3. Bulkheads and tanks

3 elements — 3 pass, 0 FAIL

ID	Zone	Design P (kN/m2)	req. t/W	actual t/W	Util.	Status
MAMPARO-COLISION	bulkhead	11.20	12.20 mm	12.50 mm	102%	OK
MAMPARO-ESTANCO	bulkhead	11.20	12.20 mm	12.50 mm	102%	OK
MAMPARO-TANQUE	tank	10.00	9.22 mm	9.50 mm	103%	OK

Detail:

- **MAMPARO-COLISION**: Mamparo MAMPARO-COLISION (collision): p_d=11.2 kN/m2; espesor real=12.50 mm, minimo exigido=12.20 mm (sigma_d=42.8 MPa, hB=1.60 m) -> OK.
- **MAMPARO-ESTANCO**: Mamparo MAMPARO-ESTANCO (watertight): p_d=11.2 kN/m2; espesor real=12.50 mm, minimo exigido=12.20 mm (sigma_d=42.8 MPa, hB=1.60 m) -> OK.

• **MAMPARO-TANQUE**: Mamparo MAMPARO-TANQUE (tank): p_d=10.0 kN/m2; espesor real=9.50 mm, minimo exigido=9.22 mm (sigma_d=42.8 MPa, hB=1.00 m) -> OK.

4. Stiffeners (beams, frames, longitudinals)

14 elements — 14 pass, 0 FAIL

ID	Zone	Design P (kN/m2)	req. t/W	actual t/W	Util.	Status
CUAD-TRANS-FONDO-MEDIA	bottom	30.69	3.7 cm3	4.2 cm3	114%	OK
LONG-FONDO-MEDIA	bottom	30.69	5.2 cm3	6.0 cm3	115%	OK
VARENG-TRANS-COSTADO-MEDIA	side	19.58	2.3 cm3	2.7 cm3	114%	OK
LONG-COSTADO-MEDIA	side	19.76	3.4 cm3	3.4 cm3	100%	OK
BAO-TRANS-CUBIERTA-MEDIA	deck	5.00	0.6 cm3	0.7 cm3	112%	OK
LONG-CUBIERTA-MEDIA	deck	5.00	0.9 cm3	1.0 cm3	122%	OK
CUAD-TRANS-FONDO-PROA	bottom	35.65	4.3 cm3	5.0 cm3	118%	OK
LONG-FONDO-PROA	bottom	35.65	6.1 cm3	7.0 cm3	116%	OK
VARENG-TRANS-COSTADO-PROA	side	24.44	2.9 cm3	3.4 cm3	116%	OK
LONG-COSTADO-PROA	side	24.64	4.2 cm3	5.0 cm3	120%	OK
BAO-TRANS-CUBIERTA-PROA	deck	5.91	0.7 cm3	1.0 cm3	148%	OK
LONG-CUBIERTA-PROA	deck	6.11	1.0 cm3	1.5 cm3	144%	OK
BAO-TRANS-CUBMOJADA-MEDIA	wetdeck	10.50	1.3 cm3	1.5 cm3	120%	OK
VAGRA-LONG-CUBMOJADA-MEDIA	wetdeck	10.50	1.8 cm3	2.0 cm3	114%	OK

Detail:

• **CUAD-TRANS-FONDO-MEDIA**: Refuerzo CUAD-TRANS-FONDO-MEDIA (bottom, flat_bar, apoyo FF): p_d=30.7 kN/m2; Fd=2685 N; Md=156.57 Nm; W_real=4.2 cm3, W_req=3.7 cm3; tau=5.4 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **LONG-FONDO-MEDIA**: Refuerzo LONG-FONDO-MEDIA (bottom, flat_bar, apoyo FF): p_d=30.7 kN/m2; Fd=2685 N; Md=223.68 Nm; W_real=6.0 cm3, W_req=5.2 cm3; tau=4.5 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **VARENG-TRANS-COSTADO-MEDIA**: Refuerzo VARENG-TRANS-COSTADO-MEDIA (side, flat_bar, apoyo FF): p_d=19.6 kN/m2; Fd=1714 N; Md=99.92 Nm; W_real=2.7 cm3, W_req=2.3 cm3; tau=4.3 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **LONG-COSTADO-MEDIA**: Refuerzo LONG-COSTADO-MEDIA (side, flat_bar, apoyo FF): p_d=19.8 kN/m2; Fd=1729 N; Md=144.03 Nm; W_real=3.4 cm3, W_req=3.4 cm3; tau=3.8 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **BAO-TRANS-CUBIERTA-MEDIA**: Refuerzo BAO-TRANS-CUBIERTA-MEDIA (deck, flat_bar, apoyo FF): p_d=5.0 kN/m2; Fd=438 N; Md=25.51 Nm; W_real=0.7 cm3, W_req=0.6 cm3; tau=2.2 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **LONG-CUBIERTA-MEDIA**: Refuerzo LONG-CUBIERTA-MEDIA (deck, flat_bar, apoyo FF): p_d=5.0 kN/m2; Fd=438 N; Md=36.44 Nm; W_real=1.0 cm3, W_req=0.9 cm3; tau=1.8 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **CUAD-TRANS-FONDO-PROA**: Refuerzo CUAD-TRANS-FONDO-PROA (bottom, flat_bar, apoyo FF): p_d=35.7 kN/m2; Fd=3120 N; Md=181.91 Nm; W_real=5.0 cm3, W_req=4.3 cm3; tau=5.7 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **LONG-FONDO-PROA**: Refuerzo LONG-FONDO-PROA (bottom, flat_bar, apoyo FF): p_d=35.7 kN/m2; Fd=3120 N; Md=259.87 Nm; W_real=7.0 cm3, W_req=6.1 cm3; tau=4.8 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **VARENG-TRANS-COSTADO-PROA**: Refuerzo VARENG-TRANS-COSTADO-PROA (side, flat_bar, apoyo FF): p_d=24.4 kN/m2; Fd=2139 N; Md=124.72 Nm; W_real=3.4 cm3, W_req=2.9 cm3; tau=4.8 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **LONG-COSTADO-PROA**: Refuerzo LONG-COSTADO-PROA (side, flat_bar, apoyo FF): p_d=24.6 kN/m2; Fd=2156 N; Md=179.58 Nm; W_real=5.0 cm3, W_req=4.2 cm3; tau=3.9 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **BAO-TRANS-CUBIERTA-PROA**: Refuerzo BAO-TRANS-CUBIERTA-PROA (deck, flat_bar, apoyo FF): p_d=5.9 kN/m2; Fd=517 N; Md=30.17 Nm; W_real=1.0 cm3, W_req=0.7 cm3; tau=2.1 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **LONG-CUBIERTA-PROA**: Refuerzo LONG-CUBIERTA-PROA (deck, flat_bar, apoyo FF): p_d=6.1 kN/m2; Fd=535 N; Md=44.54 Nm; W_real=1.5 cm3, W_req=1.0 cm3; tau=1.8 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **BAO-TRANS-CUBMOJADA-MEDIA**: Refuerzo BAO-TRANS-CUBMOJADA-MEDIA (wetdeck, flat_bar, apoyo FF): p_d=10.5 kN/m2; Fd=919 N; Md=53.57 Nm; W_real=1.5 cm3, W_req=1.3 cm3; tau=3.1 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

• **VAGRA-LONG-CUBMOJADA-MEDIA**: Refuerzo VAGRA-LONG-CUBMOJADA-MEDIA (wetdeck, flat_bar, apoyo FF): p_d=10.5 kN/m2; Fd=919 N; Md=76.53 Nm; W_real=2.0 cm3, W_req=1.8 cm3; tau=2.6 MPa vs tau_d=38.5 MPa (OK cortante) -> OK.

5. Known limitations of this implementation

• **P_SMP (planing side pressure):** approximated with chine height Z_C = 0. May be conservative or not; review manually for critical planing designs.

• **Z_SDA (actual deck height):** assumed equal to Z_SDT (Table 3) unless the user states otherwise.

• **kSLS:** defaults to 1 unless GZmax<60 is supplied (Table 11).

• **Sandwich skin section modulus:** SM = t x d approximation, not the full Annex E derivation.

• **Stiffener slenderness (Table A.12):** not checked.

• **Stiffener effective plating width (b_e, Table A.11):** not modelled (conservative side).

• **ISO 12215-5 Methods 2 to 6** (ply-by-ply analysis, FEM, testing): out of scope; only Method 1 (Simplified) is implemented, which is the method generally accepted by Notified Bodies for conventional designs.

• **ISO 12215-9 (rigging) and ISO 12215-10 (windows/hatches/ports):** not implemented — must be verified separately.

• **Rudders (ISO 12215-8):** standalone module, see the rudders tab if enabled in this version.

• **MULTIHULL — local deadrise beta_x:** approximated with the global BETA04 value for the kDR planing-bottom factor.

• **MULTIHULL — planing/displacement mode (motor):** both tables (6 and 7) are ALWAYS computed and the higher pressure is used, instead of requiring the user to declare whether the multihull planes (more conservative).

• **MULTIHULL — TRIMARAN:** side floats (Table 8) reuse the central hull's height references instead of their own geometry (Figures 2d-2f) — review manually.

• **MULTIHULL — ISO 12215-7 Chapter 12 (GLOBAL LOADS: diagonal sea load, rigging loads, bow-diving, bridging-structure bending/torsion between hulls): NOT implemented.** This is a GLOBAL structural analysis independent of the local panel/stiffener scantlings this software does calculate. A real multihull needs BOTH analyses — have Chapter 12 (Annexes B/C/D) reviewed by a naval architect with multihull experience before building.

6. Standard scope applied

ISO 12215-5:2019 Method 1 (Simplified): Tables 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17 and Annex A (clauses A.2 to A.10). ISO 12215-7:2020: Tables 5 to 8 (multihull pressures) and applicable local scantling clauses.