INTERNATIONAL MARINE CERTIFICATION INSTITUTE

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ISO 12217-1:2015 NON-SAILING BOATS OF LENGTH GREATER THAN OR EQUAL TO 6m

Manufacturer:	
Signatory, Name:	
Signatory, Title:	
Phone:	
Email:	
WWW:	
CIN Model Year:	
Model Name:	

blue cells are derived values
yellow cells require data input

Please make sure to set your signature on the summary! (worksheet 12)
either digitally or print summary, sign and attach scan

- most worksheets have additional comments / remarks / other calculations beside the printout area; please take into account.

- For boats in category A and B either fill in worksheet 6c and 6d or attach curve of righting moments for both loading conditions to the documentation.

- For boats with quick-draining cockpit the cockpit calculation according to ISO 11812 shall be enclosed to the documentation.

- Please attach other detailed information as appropriate, e.g. photos, sketches etc. for sill height, openings, companion way doors, location of flooding points, practical tests etc.

ISO 12217-1 NON-SAILING BOATS OF LENGTH GREATER THAN OR EQUAL TO 6m
CALCULATION WORKSHEET No. 1

Design Category intended:	**Monohull / multihull:**		**Propul.Type**	
Item	**Symbol**	**Unit**	**Value**	**Ref.**
Length of hull as in ISO 8666	L_H	m		3.3.1
Length of waterline in loaded arrival condition	L_{wl}	m		3.3.2
Empty Craft condition mass	m_{EC}	kg		3.4.1
standard equipment		kg		3.5.12
water ballast in tanks which are notified in the owner's manual to be filled when the boat is afloat		kg		3.4.2
Light craft condition mass	m_{LC}	kg		3.4.2
Mass of:				
Desired crew limit	CL	----		3.5.3
Mass of:				
desired crew limit at 75 kg each		kg		
provisions + personal effects		kg		3.4.4
drinking water		kg		3.4.4
fuel		kg		3.4.4
lubricating and hydraulic oils		kg		3.4.4
black water		kg		3.4.4
grey water		kg		3.4.4
water ballast		kg		3.4.4
other fluids carried aboard		kg		3.4.4
stores, spare gear and cargo (if any)		kg		3.4.4
optional equipment and fittings not included in basic outfit		kg		3.4.4
inflatable life raft(s) in excess of essential safety equipment		kg		3.4.4
other small boats carried aboard		kg		3.4.4
margin for future additions		kg		3.4.4
Maximum load = sum of above masses	m_L	kg		3.4.4
Maximum Load condition mass	m_{LDC}	kg		3.4.5
mass to be removed for loaded arrival condition		kg		3.4.6
Loaded Arrival condition mass	m_{LA}	kg		3.4.6
Mass of:				
minimum number of crew according to 3.4.3		kg		3.4.3a)
non-consumable stores and equipment normally aboard		kg		3.4.3b)
inflatable life raft		kg		3.4.3
Load to be included in Minimum Operating Condition	m'_L	kg		3.4.3
Light craft condition mass	m_{LC}	kg		3.4.2
Mass in the Minimum Operating Condition	m_{MO}	kg		3.4.3
Is boat sail or non-sail?				3.1.2
Nominal sail area	A_S	m^2		3.3.8
Sail area / displacement ratio = $A_S / (m_{LDC})^{2/3}$		-----		3.1.2
CLASSIFIED AS [non-sail if AS / (mLDC)2/3 < 0.07]	SAIL/NON-SAIL ?			3.1.2
NB If NON_SAIL, continue using these worksheets, if SAIL, use ISO 12217-2				

ISO 12217-1 CALCULATION WORKSHEET No.2 TESTS TO BE APPLIED

Question	Answer	Ref.
Is boat fully enclosed? (see definition in ref.) YES/NO?		3.1.6
Is boat partially protected? (see definition in ref.) YES/NO?		3.1.7

Item	Symbol	Unit	Value	Ref.
Windage area in minimum operating condition	A_{LV}	m^2		3.3.7
Length of waterline in loaded arrival condition	L_{wl}	m		3.3.2
Beam of hull	B_H	m		3.3.3
Freeboard ad midships	F_M	m		3.3.5
Ratio A_{LV}/L_{WL} B_H)		----		

Choose any ONE of the following options and use all the worksheets indicated for that option.

Option		1	2	3	4	5	6
Categories possible		A and B	C and D	B	C and D	C and D	C and D
Decking or covering		fully enclosed	fully enclosed	any amount	any amount	partially protected	any amount
Downflooding openings		3	3	3	3	3	3
downflooding angle		3		3			
Downflooding height test	All boats	3	3	3	3[a]	3	3
	Annex A method	4	4	4	4[a]	4	4
Offset load test		5	5	5	5	5	5
Resistance to waves + wind		6		6			
Heel due to wind action			7[b]		7[b]	7[b]	7[b]
Recess size		8	8[c]				8[c]
Habitable multihulls		9	9	9	9	9	9
Motor sailers		9	9	9	9	9	9
Flotation test				10	10		
Flotation material				10	10		
Detection and removal of water		11	11	11	11	11	11
SUMMARY		12	12	12	12	12	12

a. The downflooding height test is not required to be conducted on the following Category C and D boats:
I. those which, when tested in accordance with normative annex F.4, have been shown to support, in addition to the mass required by F.2 and Table F.5, an additional equivalent dry mass (kg) of (75·CL + 10% of dry weight of stores and equipment included in the maximum total load), or
II. those boats that do not take on water when heeled to 90° from the upright in the light craft condition.

b. The application of Worksheet 7 is only required for boats where $A_{LV}/(L_H B_H) > 0,5$.

c. Only required for boats of design category C; for option 6 clause 6.5.4 only

Option selected	

ISO 12217-1 CALCULATION WORKSHEET No. 3 DOWNFLOODING

Downflooding Openings:

Question	Answer	Ref.
Have all appropriate downflooding openings been identified?		3.1.2
Have potential downflooding openings within the boat been identified?		6.1.1.4
Do all closing appliances satisfy ISO 12216?		6.1.1.1
Hatches or opening type appliances are not fitted below minimum height above waterline?		6.1.1.2
Seacocks comply with requirements?		6.1.1.3
Are all openings on design category A or B boats fitted with closing appliances? (Except openings for ventilation and engine combustion)		6.1.1.5
Categories possible: A or B if all are YES, C or D if first five are YES		6.1.1

Downflooding angle (required for cat A & B only):

Item	Symbol	Unit	Value	Ref.
Required value: (where $ø_O$ = angle from offset load test)				6.1.3
Category A = larger of (øO + 25)° or 30°	$ø_{D(R)}$	degrees		Table 3
Category B = larger of (øO + 15)° or 25°	$ø_{D(R)}$	degrees		Table 3
Area of openings permitted to be submerged = $1.2L_H B_H F_M$		mm^2		6.1.3
Actual downflooding angle: at mass = m_{MO}	$ø_{DA}$	degrees		6.1.3
at mass = m_{LA}	$ø_{DA}$	degrees		6.1.3
Method used to determine $ø_D$:				Annex C
Design category possible on Downflooding Angle:				6.1.3

Downflooding Height:

Requirement			Basic require-ment	Reduced value for small openings	Reduced value at outboard	Increased value at bow
Applicable to			all options	all options (only if figures are used)	options 3, 4 or 6	options 3, 4, 6
ref.			6.1.2.2 a)	6.1.2.2 d)	6.1.2.2 c)	6.1.2.2 b)
obtained from Figs. 3 + 4 or annex A?				= basic x 0.75	= basic x 0.80	= basic x 1.15
Maximum area of small openings ($50L_H^2$) (mm^2) =				0	/////////	////////
Required downflooding height $h_{D(R)}$	Fig. 3/ann. A	Category A				
	Fig. 3/ann. A	Category B				
	Fig. 3/ann. A	Category C				
	Fig. 4/ann. A	Category D				
Actual Downflooding Height h_D						
Design Category possible						
Design Category possible on Downflooding Height = lowest of above						

ISO 12217-1 CALCULATION WORKSHEET No.4 DOWNFLOODING HEIGHT

Calculation using annex A

Item		Symbol	Unit	Opening 1	Opening 2	Opening 3	Opening 4
Position of openings							
Least longitudinal distance from bow/stern		x	m				
Least travers distance from gunwale		y	m				
F_1 = greater of$(1 - x/L_H)$ or $(1 - y/B_H)$		F_1	----				
Size of openings: $1+\frac{x'_D}{L_H}\left(\frac{\sqrt{a}}{75L_H}-0{,}4\right)$							
Combined area of openings to top of any down-flooding opening		a	mm^2				
Longitudinal distance of opening from tip of bow		x'_D	m				
Limiting value of a = $(30L_H)^2$			mm^2	0	0	0	0
If $a \geq (30L_H)^2$, F_2 = 1,0 If $a < (30L_H)^2$, F_2 =		F_2	----				
Size of recesses:							
Volume of recesses which are not self-draining in accordance with ISO 11812		V_R	m^3				
Is opening not a recess? Is cockpit quickdraining? Is cockpit not quickdraining?							
$k = V_R/(L_H B_H F_M)$		k	----				
If opening is not a recess, $F_3 = 1$ If recess is quickdraining, $F_3 = 0.7$ If recess is not quick draining, $F_3 = (0.7 + k^{0.5})$		F_3	----				
Displacement:							
Loaded displacement volume (see 3.4.5)		V_D	m^3				
B = B_H for monohulls, B_{WL} for multihulls		B	m				
$F_4 = [(10\,V_D)/(L_H\,B^2)]^{1/3}$		F_4	----				
Flotation:							
For boats using option 3 or 4, $F_5 = 0.8$ For all other boats, $F_5 = 1.0$		F_5	----				
Required calculation height: = $F_1F_2F_3F_4F_5L_H/15$		$h_{D(R)}$	m				
Required downfooding height with limits applied (see annex A, Table A.1)	Category A	$h_{D(R)}$	m				
	Category B	$h_{D(R)}$	m				
	Category C	$h_{D(R)}$	m				
	Category D	$h_{D(R)}$	m				
Measured Downflooding Height:		h_D	m				
Design Category possible:							
Lowest of above =							

ISO 12217-1 CALCULATION WORKSHEET - No. 5a OFFSET LOAD TEST

Mass of people used for test

Name	Ident.	Mass (kg)
Person 1	A	
Person 2	B	
Person 3	C	
Person 4	D	
Person 5	E	
Person 6	F	
Person 7	G	
Person 8	H	
Person 9	I	
Person 10	J	

downflooding opening obvious to the crew?

Offset Load Test

Name	Ident.	Mass (kg)
Person 11	K	
Person 12	L	
Person 13	N	
Person 14	M	
Person 15	O	
Person 16	P	
Person 17	Q	
Person 18	R	
Person 19	S	
Person 20	T	

average mass per person:
number of persons permitted (through offset load test)

Crew Area
Areas included and access limitations (if any):

Area	P/S	Incl?	Persons limit
Main Cockpit			
Aft Cockpit			
Fwd Cockpit			
Salon			
Cabins			
Side Decks			
Fore Deck			

Area	P/S	Incl?	Persons limit
Cuddy Top			
Coachroof Top			
Wheelhouse Top			
Fly Bridge			
Swim Platform			

Sketch: Indicate possible seating locations along the length of the side to be tested using numbers, so that these may later be used to record the positions that people actually occupy. Locations should not be closer than 0.5 m between centers, and not less than 0.2 m from outboard adge unless on sidedecks less than 0.4 m wide.

1) Note whether it is asymmetric by adding P (port) or S (starboard) to denote the larger side.

ISO 12217-1 CALCULATION WORKSHEET - No. 5b **OFFSET-LOAD TEST**

Stability Test - Full Procedure

Boat being tested for:		**stability**		**downflooding** please mark			
L_H (m)	**Min. permitted freeboard margin (m) (see Table 5)**	**Max. permitted heel angle (°)** $= 11{,}5 + \frac{(24 - LH)^3}{520}$		**Intended crew limit (CL)**	**Intended design category**	**Mass Test weights per person (kg) (Cat D only)**	**Max. Mass of test weights (kg) (= 98 x CL)**
Does boat have a list?				If "YES" to which side?			
Is crew area asymetric?				If "YES" to which side?			
Is downflooding asymetric?				If "YES" to which side?			
Boat tested:							

Test Data:

Mass ident.	**Location**		**Mass (kg)**	**Total mass (kg)**	**Lever (m)**	**Moment (kg-m)**	**Heel angle (°) P/S**	**min. freeb'd (m)**	
	area	**fore & aft**						**fwd**	**aft**
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
						Σ	**max. angle**	**min freeboard**	
total:									

Max. mass of people allowed per above:		**hence CL =**		**at**		**kg / person**	
Design category given:							
Safety Signs Required:	**Fig B1:**		**Fig B2:**		**Fig B3:**		

ISO 12217-1 CALCULATION WORKSHEET No. 5c Simplified procedure for OFFSET LOAD TEST

This method may only be applied by calculation; requirements must be fulfilled for both conditions LC1 and LC2

Preparation (curves of moments in Nm)

Question	Answer	ref.
Mass and the centre-of-gravity of the boat calculated for conditions LC1 and LC2?		**B.3.2.2**
Curves of righting moments calculated according to annex D?		**B.3.2.3**
Crew heeling moment curve calculated with 961 CL (B_C/2 - 0,2) cos ϕ or where the crew area includes side decks less than 0,4m wide with 480 CL BC cos ϕ ?		**B.3.2.4**

Test data:

item	symbol	unit	LC1	LC2	ref.
Maximum transverse distance between the outboard extremities of any part of the crew area	B_C	m			**B.3.2.4 & B.3.1.7**
Heel angle at the point of intersection between crew heeling moment curve and the curve of righting moment	ϕ_C	degrees			
Maximum permitted heel angle	$\phi_{O(R)}$	degrees			**B.3.2.5**
Value of downflooding angle	ϕ_{DA}	degrees			**B.3.2.5**
Value of minimum freeboard margin at ϕ_C	h_F	m			
Minimum required freebord margin	$h_{F(R)}$	m			**6.2.2 table 4**
Righting moment at ϕ_D		Nm			
Crew heeling moment at ϕ_D		Nm			

Requirements:

Question		Answer		ref.
Is $\phi_C < \phi_{O(R)}$				**B.3.2.5**
Is $h_F > h_{F(R)}$				**B.3.2.6**
Is the righting moment at ϕ_D > crew heeling moment at ϕ_D?				**B.3.2.7**

			ref.
Offset load test passed, if all questions above are answered with 'yes' (or n.a.)	**Pass/Fail**		**B.3.2.7**

ISO 12217-1 CALCULATION WORKSHEET No. 5d curve of righting moment LC1

insert curve of righting moment in 5° steps in one of following units:

OFFSET LOAD TEST

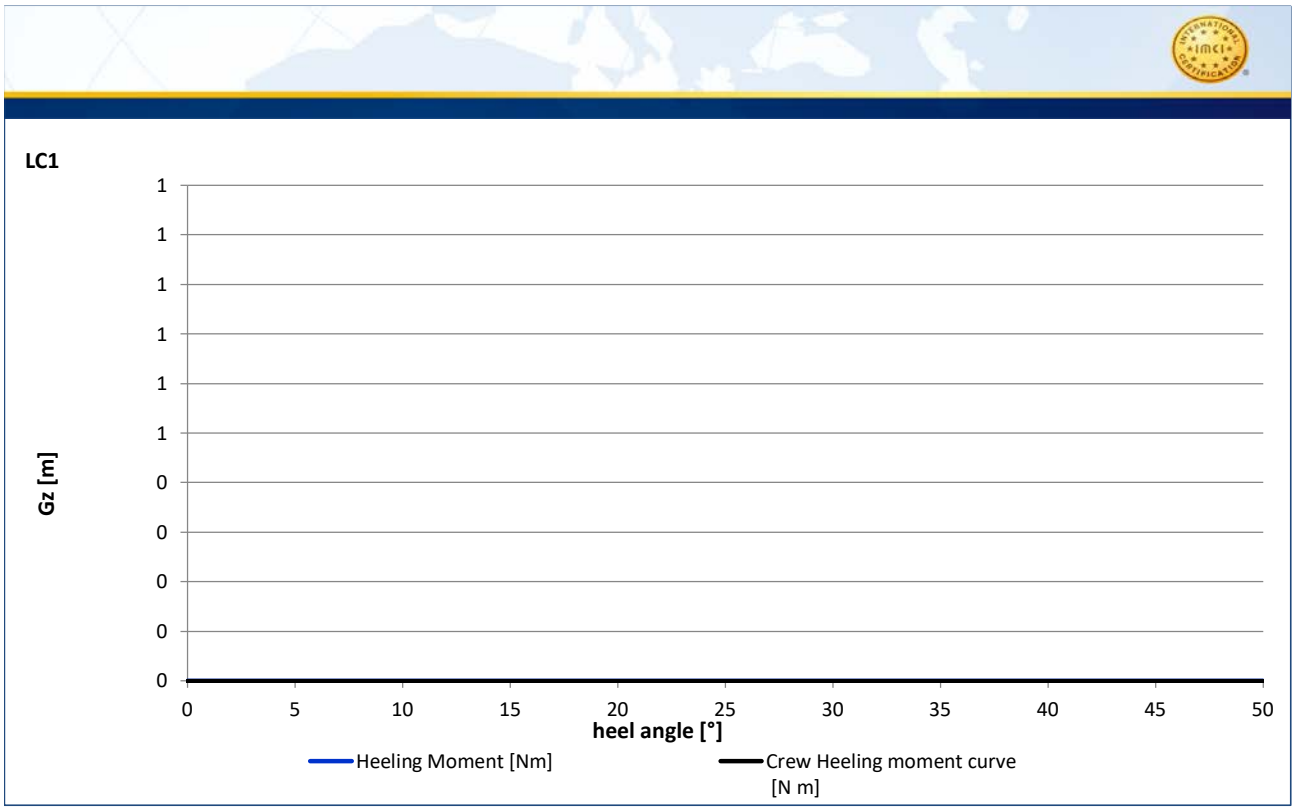
N m	*kg m*	*m*	*mLC1*

	chosen unit
	crew heeling moment curve (either normal or if side decks smaller 0,4m)

heeling angle[°]	insert Heeling Arm / Moment [Nm, kg m, m]	Heeling Moment [Nm]	Heeling Moment [kg m]	Arm Gz [m]	Crew Heeling moment curve [N m]
0					
5					
10					
15					
20					
25					
30					
35					
40					
45					
50					

point of intersection of righting moment curve and crew heeling moment curve

Φ_C



ISO 12217-1 CALCULATION WORKSHEET No. 5e curve of righting moment LC2

insert curve of righting moment in 5° steps in one of following units:

OFFSET LOAD TEST

N m	*kg m*	*m*	*mLC2*

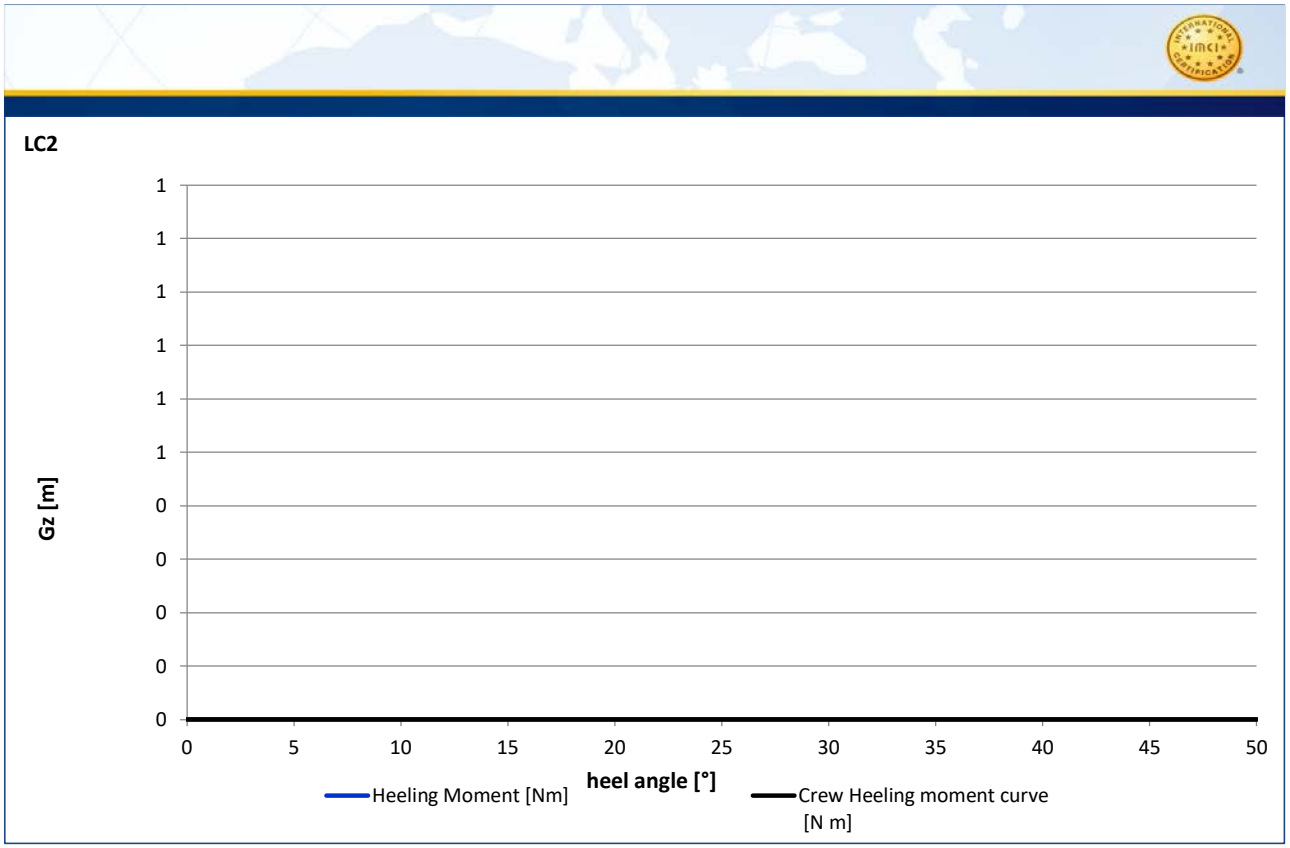
chosen unit

crew heeling moment curve (either normal or if side decks smaller 0,4m)

heeling angle[°]	insert Heeling Arm/Moment [Nm, kg m, m]	Heeling Moment [Nm]	Heeling Moment [kg m]	Arm Gz [m]	Crew Heeling moment curve [N m]
0					
5					
10					
15					
20					
25					
30					
35					
40					
45					
50					

point of intersection of righting moment curve and crew heeling moment curve

Φ_C



ISO 12217-1 CALCULATION WORKSHEET No. 6a RESISTANCE TO WAVES+WIND

Input data: **Design categories A and B only**

Item	Symbol	Unit	m_{LA}	m_{MO}	Ref.
Mass in minimum operating condition	m_{MO}	kg			3.4.3
Loaded arrival masss	m_{LA}	kg			3.4.6
Displacement volume (= m_{MO}/1025 or m_{LA}/1025)	V_D	m^3			3.4.7
Windage area (of above water profile of boat)	A_{LV}	m^2			3.3.7
Windage area to be used (not to be < 0.5 $L_H B_H$)	A'_{LV}	m^2			6.3.2
Length waterline	L_{WL}	m			3.3.2
Lever between centroids of above and below water areas	h	m			6.3.2
Draught of canoe body at the mid-point of the waterline length	T_M	m			
Downflooding angle	$ø_{DA}$	degrees			3.2.2
Calculation windspeed	v_W	m/s			3.5.1

ISO 12217-1 CALCULATION WORKSHEET No. 6b RESISTANCE TO WAVES+WIND

Rolling in beam waves and wind: **Design categories A and B only**

Item	Symbol	Unit	m_{LA}	m_{MO}	Ref.
Second wind heel equilibrium angle		degrees			Fig. 6
Least value of $ø_{DA}$, 50^0 or second wind heel equilibrium angle	$ø_{A2}$	degrees			Fig. 6
Wind heeling moment (1) $= 0.53\ A'_{LV}\ h\ v_W^2$	M_{W1}	N-m			6.3.2
Wind heeling moment (2) $= 0.30\ A'_{LV}\ (A'_{LV} / L_{WL} + T_M)\ v_W^2$	M_{W2}	N-m			6.3.2
Assumed roll angle Category A = $(25+20/V_D)$	$ø_R$	degrees			6.3.2
Category B = $(20+20/V_D)$	$ø_R$	degrees			6.3.2
Area 1 (see fig. 6)	A_1	any			Fig. 6
Area 2 (see fig. 6)	A_2	any			Fig. 6
Ratio of A_2/A_1		--			6.3.2
Is ratio of A_2/A_1 greater than or equal to 1.0?	*YES / NO*				6.3.2

Resistance to waves:

Item	Symbol	Unit	m_{LA}	m_{MO}	Ref.
Least value of $ø_{DA}$, 50^0 or second wind heel equilibrium angle		degrees			6.3.3
Heel angle when righting moment is maximum	$ø_{GZMax}$	degrees			6.3.3
If $ø_{GZMax}$ is greater than or equal to 30^o Max value of righting moment @ 30^o heel?	RM_{30}	kN m			6.3.3a)
Required value of righting moment		kN m			6.3.3a)
Is RM_{30} greater than or equal to required max value?					6.3.3b)
Value of righting lever at 30^0 = RM_{30}/(9.806*mass)	GZ_{30}	m			3.5.10
Required value of righting lever at 30^0		m			6.3.3a)
Is GZ_{30} greater than or equal to required max value?					6.3.3a)
IF $ø_{GZMax}$ is less than 30^o Max value of righting moment	RM_{MAX}	kN m			6.3.3b)
Required value of RM_{MAX} (A = 750/$ø_{GZMax}$, B = 210/$ø_{GZMax}$		kN m			6.3.3b)
Is RM_{MAX} greater than or equal to required max value?					6.3.3b)
Max value of righting lever = RM_{MAX}/(9.806*mass)	GZ_{Max}	m			3.5.10
Required max value of righting lever = 6/$ø_{GZMax}$		m			6.3.3b)
Is GZ_{MAX} greater than or equal to the required max value? PASS / FAIL					6.3.3b)

Design Category given: NB: Boat must have ratio of A2/A1 greater than or equal to 1.0, and also get PASS twice under resistance to waves.	

ISO 12217-1 CALCULATION WORKSHEET No. 6c curve of righting moment m_{LA}

insert curve of righting moment in 5° steps in one of following units:

	N m	*kg m*	*m*
chosen unit			
chose of M_W			

heeling angle[°]	insert Heeling Arm/Moment [Nm, kg m, m]	Heeling Moment [Nm]	Heeling Moment [kg m]	Arm Gz [m]	Wind Heeling moment curve [m]
-25					
-20					
-15					
-10					
-5					
0					
5					
10					
15					
20					
25					
30					
35					
40					
45					
50					
55					
60					
65					
70					

area A1 and A2 limits

	heel degrees		heel degrees	
A1 from		to		below M_W
A2 from		to		above M_W

point of intersection of righting moment curve and wind heeling moment curve

Φ_W
#NV

Mw		Nm
Mw		kg m
Mw		m
Φ_W		degrees
Φ_{A2}		degrees
Φ_R		degrees

Max mLA		m
heel at GZ max		degrees

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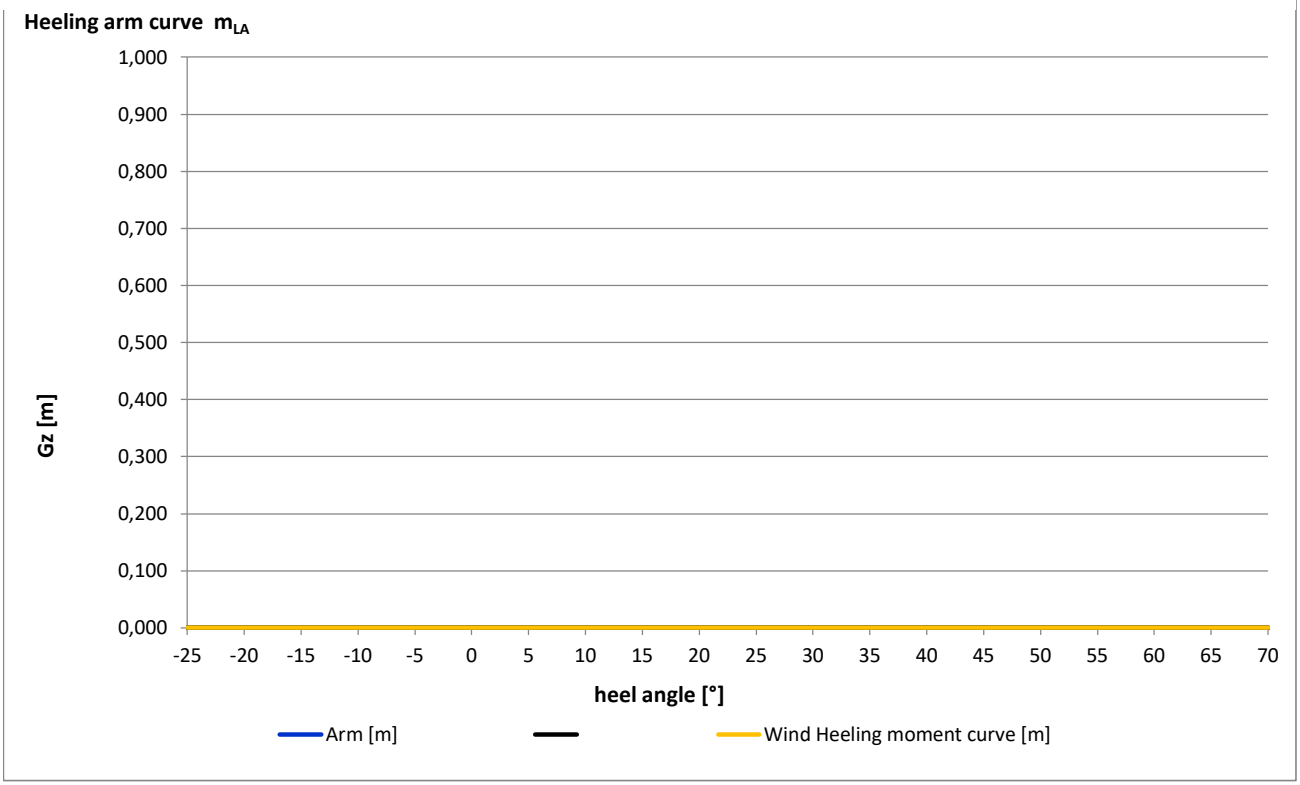

ISO 12217-1 CALCULATION WORKSHEET No. 6d curve of righting moment m_{MO}

insert curve of righting moment in 5° steps in one of following units:

	N m	*kg m*	*m*
chosen unit			
chose of M_W			

heeling angle[°]	insert Heeling Arm/Moment [Nm, kg m, m]	Heeling Moment [Nm]	Heeling Moment [kg m]	Arm Gz [m]	Wind Heeling moment curve [m]
-25					
-20					
-15					
-10					
-5					
0					
5					
10					
15					
20					
25					
30					
35					
40					
45					
50					
55					
60					
65					
70					

area A1 and A2 limits

	heel degrees		heel degrees	
A1 from		to		below M_W
A2 from		to		above M_W

point of intersection of righting moment curve and wind heeling moment curve

Φ_W
#NV

Mw		Nm
Mw		kg m
Mw		m
Φ_W		degrees
Φ_{A2}		degrees
Φ_R		degrees

Max mMO		m
heel at GZ max		degrees

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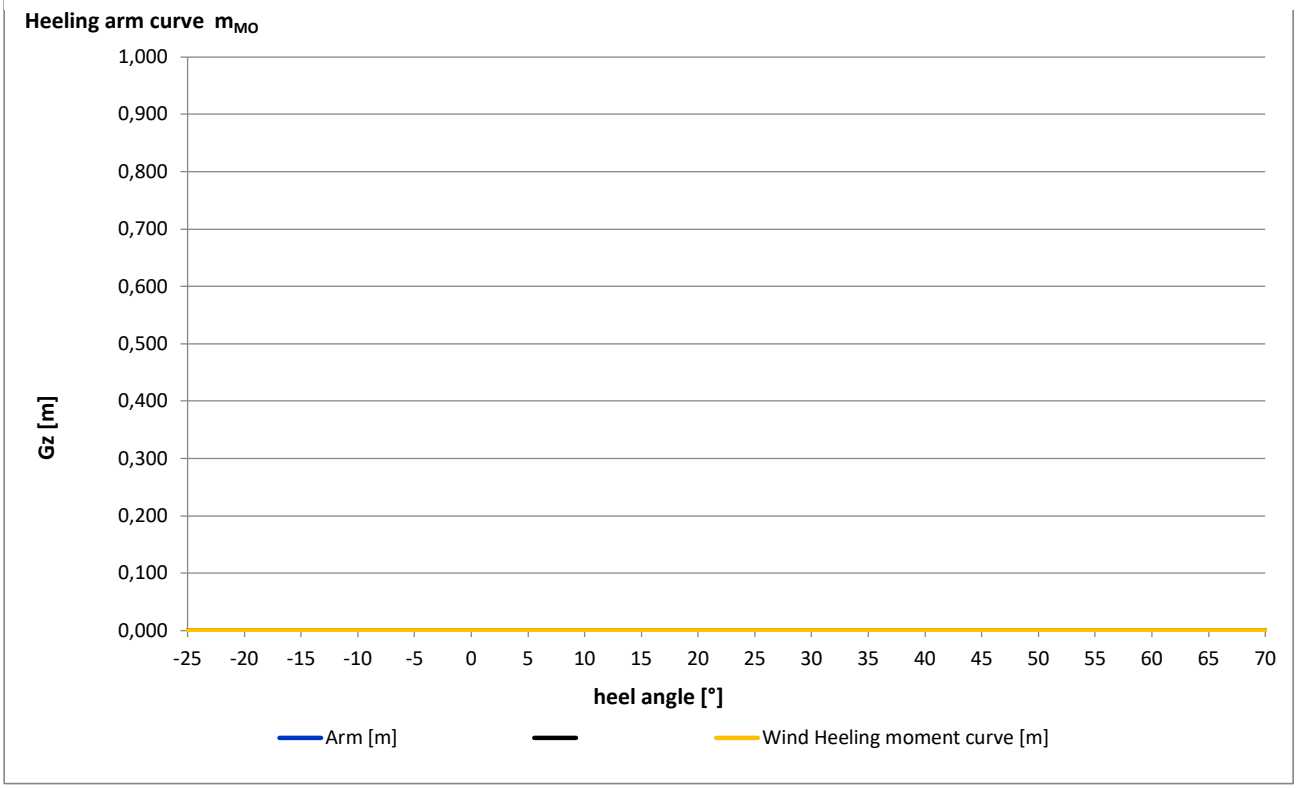

ISO 12217-1:2015 CALCULATION WORKSHEET No.7 **HEEL DUE TO WIND ACTION**

NB: This sheet is to be completed for both Minimum Operating and Loaded arrival condition

Initial check: **Design Categories C and D only**

Item	Symbol	Unit	m_{LA}	m_{MO}	Ref.
Windage area (NOT subject to minimum of 0.5 $L_H B_H$)	A_{LV}	m^2			3.3.7
Length of Hull	L_H	m			3.3.2
Beam of hull	B_H	m			3.3.3
Ratio $A_{LV}/(L_H B_H)$ at mMO		-----			
Is ratio $A_{LV}/(L_H B_H)$ equal to or greater than 0.5?					6.4
If answer is NO, no other assessment is required.					

Calculation of wind heeling moment:

Item	Symbol	Unit	m_{LA}	m_{MO}	Ref.
Length of waterline	L_{WL}	m			3.3.2
Draught at the mid-point of L_{WL}	T_M	m			6.3.2
Lever between centroids of above and below water areas	h	m			6.3.2
Calculation wind speed	v_W	m/s			3.5.1
Wind heeling moment $M_{W1} = 0.53\ A_{LV}\ h\ v_W^2$	M_W	Nm			6.4.2
Wind heeling moment $M_{W2} = 0.3\ A_{LV}(A_{LV}/L_{WL} + T_M)\ v_W^2$	M_W	Nm			6.4.2

Angle of heel due to wind:

Item	Symbol	Unit	m_{LA}	m_{MO}	Ref.
FROM RIGHTING MOMENT CURVE: angle of heel due to wind	$ø_W$	degrees			6.4.3
OR ALTERNATIVELY: wind heeling moment M_W divided by 9.806	M_W	kg.m			
Angle of heel due to wind when moment above applied	$ø_W$	degrees			6.4.3
Maximum permitted angle of heel during offset load test (from worksheet 5b)	$ø_{O(R)}$	degrees			6.2.3
Downflooding angle	$ø_{DA}$	degrees			3.2.2
Maximum permitted angle of heel due to wind = lesser of $0.7ø_{O(R)}$ and $0.7ø_{DA}$		degrees			6-4.3
Is angle of heel due to wind less than permitted value?					6.4.3
Design Category possible on wind heeling =					

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NB: This sheet is to be completed for the Loaded Arrival Condition.

Item	Symbol	Unit	Value		Ref.
			Recess 1	Recess 2	
Angle of vanishing stability > 90° ?		YES/NO			6.5.1a)
Depth recess < 3% max breadth of the recess over >35% of periphery?		YES/NO			6.5.1b)
Bulwark height < B_H /8 and has ≥ 5% drainage area in the lowest 25%?		YES/NO			6.5.1c)
Drainage area per side (m²) divided by recess volume (m³)					6.5.1d)
Height position of drainage area (lowest 25% / lowest 50% / full depth)					6.5.1d)
Drainage area meets requirements 1) and 2)?		YES/NO			6.5.1d)
Recess exempt from size limit?		YES/NO			

SIMPLIFIED METHOD: Use 1), 2) or 3) below.				Zone 1	Zone 2	
Requirement: from results below, design category possible =						6.5.2.1
Average freeboard to loaded waterline at aft end of recess	F_A	m				6.5.2.1
Average freeboard to loaded waterline at sides of recess	F_S	m				6.5.2.1
Average freeboard to loaded waterline at forward end of recess	F_F	m				6.5.2.1
Waterline length at mLA	L_{WL}	m				
Waterline breadth at mLA	B_{WL}	m				
Average freeboard to recess periphery $= (F_A + 2F_S + F_F) / 4$	F_R	m				6.5.2.1
Category A permitted percentage loss in metacentric height $(GM_T) = 250\ F_R / L_H$	$\frac{102\,500 \times SMA_{RECESS}}{m_{LA} \times GM_T}$					6.5.2.1
Category B permitted percentage loss in metacentric height $(GM_T) = 550\ F_R / L_H$						6.5.2.1
Category C permitted percentage loss in metacentric height $(GM_T) = 1\,200\ F_R / L_H$	$\left(\frac{245 \times SMA_{RECESS}}{SMA_{WP}}\right)$					6.5.2.1

SIMPLIFIED METHOD: Use 1), 2) or 3) below.			Zone 1	Zone 2	
1) Loss of GM_T used?					6.5.2.2
Second moment of area of free-surface of recess	SMA_{RECESS}	m^4			6.5.2.2
Metacentric height of boat at m_{LA}	GM_T	m			6.5.2.2
Calculated percentage loss in metacentric height $(GM_T) =$	$270\left(\frac{l \times b^3}{L_H \times B_H^3}\right)^{0,7}$				6.5.2.2
2) Second moment of areas used?					6.5.2.3
Second moment of area of free-surface of recess	SMA_{RECESS}	m^4			6.5.2.3
Second moment of area of waterplane of boat at m_{LA}	SMA_{WP}	m^4			6.5.2.3
Calculated percentage loss in metacentric height $(GM_T) =$					6.5.2.3
3) Recess dimensions used?					6.5.2.4
Maximum length of recess at the retention level (see 3.5.11)	l	m			6.5.2.4
Maximum breadth of recess at the retention level (see 3.5.11)	b	m			6.5.2.4
Calculated percentage loss in metacentric height $(GM_T) =$					6.5.2.4

DIRECT CALCULATION METHOD used?					6.5.3
Percentage full of water = 60 – 240 F/L_H					6.5.3a)
Wind heeling moment for intended design category	M_W	N·m			6.5.3b)
Crew heeling moment at *f*GZmax		N·m			6.5.3c)
Maximum swamped righting moment up to least of *f*D *f*V or 50°		N·m			6.5.3d)
Required margin of righting moment over heeling moment		N·m			6.5.3d)
Actual margin of righting moment over heeling moment		N·m			6.5.3d)
Design category possible					6.5.3d)
Design category achieved					

Design category C boats using option 6			
Recess entirely contained within LH/2 of the bow ?			6.5.4
Volume to retention level (see 3.5.9) larger than ($L_H B_H F_M$)/40 ?			6.5.4
If both questions are answered with 'yes' check requirements below:			
Recess is quickdraining recess either overboard or in the bilge?			6.5.4
Design category possible			6.5.4

ISO 12217-1 CALCULATION WORKSHEET No.10 FLOTATION TEST

Annexes E and F **assumed Crew Limit (CL) =**

Preparation

Item	Unit	Response	Ref.
Mass equal to 25% of dry stores and equipment added?			F.2 a)
Inboard or outboard engine fitted?			
If inboard fitted, correct engine replacement mass fitted?			F.2 d)
Assumed outboard engine power?	Kw		F.2 c)
Mass fitted to represent outboard engine, controls, and battery.	kg		Tables F.1 and F.2
Portable fuel tanks removed and/or fixed tanks are filled?			F.2 f)
Cockpit drains open and drain plugs are fitted?			F.2 g)
Void compartments which are not air tanks are opened?			F.2 i)
Number of integral air tanks required to be open?			Table F.3
Type of test weights used: lead, 65/35 brass, steel, cast iron, aluminum			F.3.2
Material factor *d*			Table F.4

Swamped stability test:

Item	Unit	Response	Ref.
Dry mass of test weights = 6*d* CL but $\geq$ 15*d*	kg		Table F.6
Test weight hung from gunwale each of four positions in turn?			F.3.1
5 min after swamping, boat heels less than 45^0			F.3.4 + F.3.5

Swamped buoyancy test:

Item	Unit	Response	Ref.
Load test:			F.4
DesignCategory assessed			
Dry mass of test weights used	kg		Table F.5
5 min after swamping, boat floats approximately level with more than 2/3 of periphery above water?			F.4.3

Swamped buoyancy test:

Item		Response	Ref.
All flotation elements comply with all requiremnets?			Table G.1

Design Category given: NB: boat must obtain PASS three times in above tables	

ISO 12217-1 CALCULATION WORKSHEET No. 11 DETECTION + REMOVAL OF WATER

Item	response	Ref.
The internal arrangement facilitates the drainage of water to bilge suction point(s), to a location from which it can be bailed rapidly, or directly overboard?		6.9.1
Is boat provided with a means of removing water from the bilges in accordance with 15083?		6.9.2
Table 2 option used for assessment:		6.9.3; 5.4 table 2
Can water in boat be detected from helm position?		6.9.3
Methods used: direct visual inspection		6.9.3
transparent inspection panels		6.9.3
bilge alarms		6.9.3
indication of the operation of automatic bilge pumps		6.9.3
other means (specify):		6.9.3

ISO 12217-1:2015 CALCULATION WORKSHEET No.12 **SUMMARY**

Design Description:		
Design Category intended:	**Crew Limit:**	**Date:**

Sheet	Item	Symbol	Unit	Value
	Length of hull: (as in ISO 8666)	L_H	m	
	Length of waterline in loaded arrival condition	L_{WL}	m	
	Mass:			
1	Empty craft mass	m_{EC}	kg	
	Maximum load	m_L	kg	
	Light craft condition mass	m_{LC}	kg	
	Maximum Loaded condition mass = $m_{LC} + m_{ML}$	m_{LDC}	kg	
	Loaded arival condition mass	m_{LA}	kg	
	Minimum operating condition mass	m_{MO}	kg	
1	**Is boat sail or non-sail?**	SAIL/NON-SAIL		
2	**Option selected:**			
3	**Downflooding openings:**	Are all requirements met?		

Sheet							
3	**Downflooding angle:** (Categories A and B only)	degrees	Required	**m_{MO}**	**m_{LA}**	**Pass/Fail**
		degrees	> 0			
3 & 4	**Downflooding height:** Worksheet employed for basic height					
	basic requirement	m	#NV			
	reduced height for small openings (only using figures)	m	#NV			
	reduced height at outboard (options 3, 4, 6 only)	m	#NV			
	increased height at bow (options 3, 4, 6 only)	m	#NV			
5	**Off-set load test:**	**Unit**	**Required**	**Actual**		**Pass/Fail**
	Testing for least stability: maximum heel angle	**degrees**	**< 0,00**			
	Testing for least freeboard: heeled freeboard margin	**m**	**> 0,00**			
	Maximum crew limit for stability					
	Maximum crew limit for freeboard					
6	**Resistance to waves and wind:** (options 1, 3) at m_{LA} and m_{MO}					
	Rolling in beam waves and wind: ratio A_2/A_1	-	≥ 1.0			
	Resistance to waves: value of $ø_{GZMax}$	degrees	---			
	value of RM_{30} or RM_{MAX}	kNm	7			
	value of GZ_{30} or GZ_{MAX}	m	0,2			
7	**Heel due to wind:** (options 2,4,5,6) at m_{LA} and at m_{MO}					
	at m_{MLA}: heel angle due to wind	degrees	<			
	if required at m_{MO}: heel angle due to wind	degrees	<			

8	**Recess size:** (options 1 and 2 except category D)				
	Simplified method: max reduction in GM_T	%	≤		
	Direct calculation: margin righting moment over heeling moment	N m	≥		
	For category C boats using option 6; drainage requirements for recesses entirely contained within LH/2 of the bow are fulfilled?				
9	**Habitable Multihulls:** Is Category C boat vulnerable to inversion?			Yes / No	
	Complies with Part 2 clause 7.12 for inverted buoyancy?			Pass / Fail	
	Complies with Part 2 clause 7.13 for means of escape?			Pass / Fail	
9	**Motor Sailers** Complies with requirement for excess of RM_{MAX} over M_W?			Pass / Fail	
10	**Flotation test:** (options 3 and 4 only) All preparations completed?			Yes / No	
	Swamped stability: 5 min after swamping, does boat heel less than 45°?			Pass / Fail	
	Load test: 5 min after swamping, does boat float level with 2/3 periphery showing?			Pass / Fail	
	Flotation elements: do all elements comply with all the require-ments?			Pass / Fail	
11	**Detection & removal of water** are all requirements satisfied?			Yes / No	

NB: Boat must pass all requirements applicable to selected option to be given intended Design Category.

Design Category given:		Assessed by:	