

INDIAN REGISTER OF SHIPPING

CLASSIFICATION NOTES

**Stability Requirements for Open
Crafts of less than 15 meters
Length fitted with Buoyancy
Material**

September 2022



IRCLASS
Indian Register of Shipping

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Section 1

Scope

1.1 The purpose of this Classification Note is to provide stability requirements for open crafts of length (L) less than 15 [m], fitted with buoyancy material. This would enable determination of maximum number of persons (passenger and crew) allowed on such crafts.

These requirements are applicable to open crafts exclusively for carrying passengers and are not applicable to crafts carrying cargo or vehicles.

1.2 The requirements in this Classification Note are not intended to replace any National or International Regulations.

1.3 Additional requirements (if any) of the Statutory Authority/ flag Administration are to be complied with, separately by the Owner/ Operator, as relevant and applicable.

Section 2

Application

2.1 The requirements in this Classification Note are applicable to open crafts with length (L) less than 15 [m] fitted with buoyancy material and operated in calm and settled weather conditions.

2.2 These requirements may also be applied to open crafts constructed with light materials having L less than 15 [m], where buoyancy material is not fitted and the craft is operated in calm and settled weather conditions.

2.3 The stability requirements of vessels of unusual or novel designs may be specially considered by IRS.

Section 3

Acceptance

3.1 The actual stability test is to be witnessed by IRS Surveyor who will endorse the test report. The final acceptance of the stability of the craft will be accorded by IRS Head Office.

Section 4

Definitions

<i>L</i>	:	Length of hull but excluding rub rails, outside rudders, outdrives, outboard motors, diving platforms, bowsprits, fittings. [m]
<i>B</i>	:	Maximum beam of hull measured at the deck level on the outside of the hull shell. In the case of catamaran craft, the full breadth of the craft including both the hulls and cross deck structure is to be considered. [m]
<i>b</i>	:	Breadth of demi-hull (at maximum load waterline) at maximum beam of craft in the case of catamarans [m]
<i>x</i>	:	Gap/ separation between the two demi hulls (at maximum load waterline) at the location of maximum beam of craft [m]
<i>T</i>	:	Maximum draught of hull in fully loaded condition. [m]
<i>D</i>	:	Depth, measured as the vertical distance between the sheer line at the half-length of the waterline and the lowest point of the keel. [m]
<i>Decked craft</i>	:	Craft with deck that can be closed weather tight from stem to stern uninterrupted by other than a strong superstructure or a cockpit so designed that shipping sea will not fill spaces below deck.
<i>Open craft</i>	:	Craft that is not a decked craft.
<i>Flooded craft</i>	:	A flooded craft is a craft in a condition in which it cannot be filled with more water.
<i>F</i>	:	Mean Freeboard: $(F_f + F_m + F_a) / 3$ [mm]
<i>F_f</i>	:	Freeboard measured at extreme forward end [mm]
<i>F_m</i>	:	Freeboard measured at $L / 2$ [mm]
<i>F_a</i>	:	Smallest Freeboard measured at extreme aft end or for boats with engine wells measured to the point where water first may enter the boat [mm]
Δ	:	Displacement in fully loaded condition. [kg]
<i>Weathertight</i>	:	Capable of preventing the admission of a significant quantity of water into the craft when subjected to a hose test;
<i>Watertight</i>	:	Capable of preventing the passage of water in either direction
<i>Administration</i>	:	Registration authority with whom the boat is registered
<i>V</i>	:	Maximum speed in knots.
<i>Persons</i>	:	Total number of passenger and crew on board Per person weight is to be considered as 75 kg, for calculation purposes.

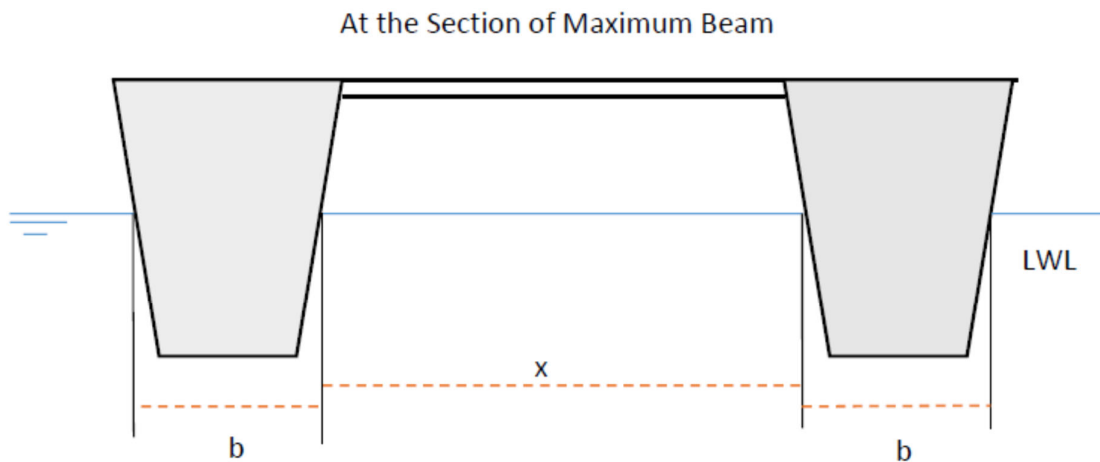


Fig. showing the measurement of 'x' and 'b' for a catamaran craft
(for representational purposes only)

Section 5

Requirements

5.1 Seats

5.1.1 A seat is to be provided for every person onboard.

5.1.2. Recommended minimum size of the seat is as follows:

- Beam 450 [mm]
- Depth 680 [mm], free space for legs measured from persons back

5.1.3 For crafts with speed exceeding 15 knots, the seats on open decks are to be atleast 100 [mm] lower than the top of bulwark/ railing. Equivalent arrangements for protecting persons from falling overboard when seated, may be accepted.

5.1.4 Sharp edges, arm rests etc. which may cause injury to persons on-board are to be avoided.

5.2 Drainage

5.2.1 Drainages with direct overboard discharge are to be fitted with non-return valves/ arrangements.

5.3 Deck Arrangement

5.3.1 Non-skid surface is to be arranged on all decks and floors intended for human occupancy or work.

5.3.2 The craft is to be provided with a rail or holding points at the outboard edge / gunwale / accessible position for the persons to hold during voyage.

5.4 Buoyancy Materials

5.4.1 The term 'buoyancy material' means a low-density material e.g. foam, which provides buoyancy to the craft when flooded. The term buoyancy material is used for such material that do not take in water when immersed in water. Wood and synthetic and compressed foam is frequently used for this purpose. One major property of this material is to withstand water pressure when under water. For guidance, the density of foam used is normally in the range of about 0.03 to 0.09 gm/cc

5.4.2 Buoyancy materials may consist of foam, prefabricated or formed in position (in-situ), or tanks and double hull filled buoyancy elements. Buoyancy elements are to be fixed or permanently fitted and protected against mechanical damage and environmental degradation.

5.4.3 Buoyancy materials are to be resistant to liquids e.g. petrol fuel. This requirement may be waived, if the material is totally encapsulated when fitted.

5.4.4 The water absorption of buoyancy materials is not to exceed 8% by volume after being submerged for 8 days according to ISO 2896:2001. Material complying with MSC.81 (70) shall be deemed to satisfy

this requirement. Results from tests or compliance to MSC. 81(70) are to be documented and provided to IRS.

5.4.5 Enclosed spaces used for buoyancy elements are normally not to be used for storage or other facilities.

5.4.6 Enclosed spaces are to be drainable. Enclosed spaces not serving as buoyancy means, but which are either empty or partly filled with foam, are to be punctured before the floatability test.

Note: In case of small enclosed spaces (i.e. small enclosed space means volume not exceeding 75 liters) which are either empty or partly filled with foam and not able to be punctured or flooded for the floatability test, weight equivalent to volume of that enclosed space multiply by 1.025 or 1.0 (for boats operating in fresh water), can be placed as an extra weight at the possible near available location of enclosed space during floatability test; and same may be accepted, subject to the satisfaction of the attending surveyor.

5.5 Ballast

5.5.1 Ballast is to be arranged so as to prevent shifting of position.

5.5.2 The ballast material is to be documented to have no corrosive or detrimental effect on the hull structure materials.

5.5.3 Ballast on cement-basis is to be specially documented with respect to arrangement and chemical reaction to hull material, drainage and protection.

5.6 Freeboard

5.6.1 Freeboard in maximum loaded condition

5.6.1.1 For craft arranged with buoyancy elements, the mean freeboard in maximum loaded condition (F), is not to be less than:

$$\begin{aligned} F &= 200 B \text{ [mm]} \text{ for mono-hull craft} \\ &= \text{[mm]} \text{ for catamarans ;} \\ &= \frac{100 B}{k} \end{aligned}$$

$$\text{Where } k = 0.5 \left(\frac{x}{b} + 1 \right)$$

x is the gap/ separation between the demi-hulls [m] at the maximum beam of craft and b is the demi-hull breadth at this location [m]

or

$$F_{\min} = 200 \text{ [mm]}$$

5.6.1.2 Craft is to have a freeboard aft of not less than:

$$F_{\text{aft}} = 0.8 F$$

5.7 Stability Requirements

5.7.1 Stability in Intact condition

5.7.1.1 In lightweight condition the craft is not to have water ingress, or the angle of heel is not to exceed 10°, for a heeling weight:

$$P = 20 \times n \text{ kg} \quad (n = \text{number of persons}), \text{ or}$$
$$P_{\text{min}} = 40 \text{ kg}$$

5.7.1.2 The heeling weight is to be placed at the gunwale at the maximum beam of the craft, and not less than B/2 from the centerline.

5.7.1.3 In maximum load condition the craft is not to capsize or have water ingress if all persons move to the same side and the angle of heel is not to exceed 10°, caused by a heeling weight:

$$P = 75 \times n \text{ kg} \quad (n = \text{total number of persons}).$$

5.7.1.4 The weight is to be located on the floor as near to the gunwale as possible, but minimum B/4 from centerline and with longitudinal position corresponding to the arrangement of the accommodation.

5.7.1.5 Weights representing equipment are to be located at their respective positions.

5.7.1.6 It is recommended that an approximate value of Metacentric height 'GM' of the vessel in maximum load condition may be determined by heeling the vessel to an angle by not more than 4 degrees using appropriate weight and location and calculation from the following :

$$GM = (P \cdot d) / (\Delta \cdot \sin \theta)$$

Where,

P = heeling weight [kg]

d = distance of heeling weight location from centre line [m]

Δ = mass displacement of the vessel in maximum load condition [kg]

θ = angle of heel, degrees

5.7.2 Buoyancy in flooded condition

5.7.2.1 In maximum load condition (including equipment, full fuel etc.) the flooded craft is to float approximately horizontal and not sink when loaded with additional weight:

$$P = 25 \times n \text{ kg} \quad (n = \text{total number of persons}), \text{ but not less than the larger of}$$
$$P = 50 + 50 (L - 2.5) \text{ kg, or}$$
$$P_{\text{min}} = 75 \text{ kg.}$$

5.7.2.2 Weights are to be located at their respective positions on board.

5.7.3 Stability in Flooded Condition

5.7.3.1 In maximum load condition (including equipment, full fuel etc.) the flooded craft is not to capsize when loaded with a weight:

$$PK = 10 + 5 \times n \text{ kg} \quad (n = \text{total number of persons}), \text{ or } PK_{\text{min}} = 25 \text{ kg,}$$

5.7.3.2 The additional weight is to be located so that the center of gravity is of the same height as the gunwale and can be located anywhere along the gunwale.

5.7.3.3 Test reporting format for individual crafts is placed at Appendix I.

Note: All tests are to be carried out only after the relevant spaces/ compartments are filled with buoyancy materials.”

5.8 Verification of Heel Angle

5.8.1 Pendulum Arrangement

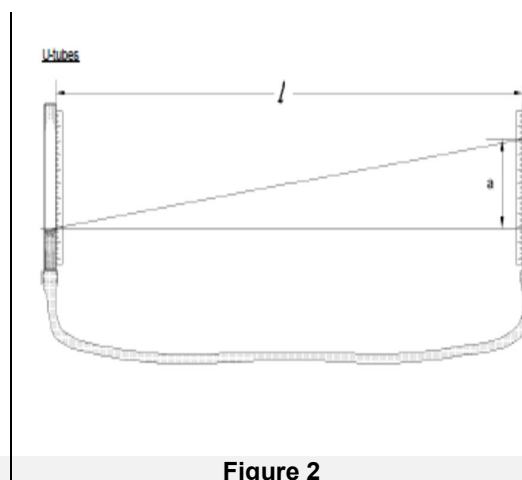
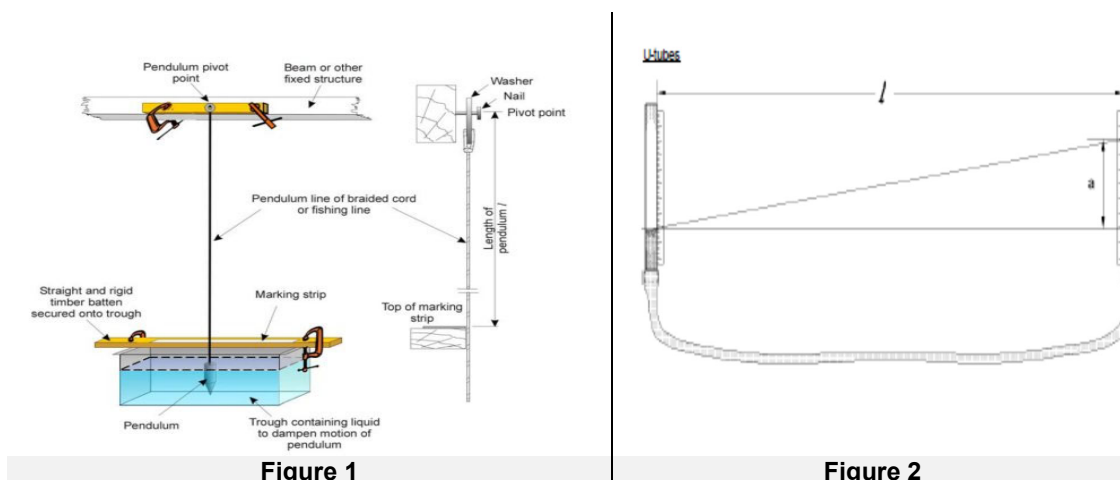
5.8.1.1 A pendulum arrangement is recommended to be used for verification of heel angle. The following are to be complied with:

.1 The pendulum used should be long enough to give a measured deflection of at least 10cm at 10 degrees. The pendulum wire should be piano wire or other monofilament material. The top connection of the pendulum should afford unrestricted rotation of the pivot point. A trough filled with a liquid should be provided to dampen oscillations of the pendulum after each weight movement. It should be deep enough to prevent the pendulum weight from touching the bottom. The use of a winged plumb bob at the end of the pendulum wire can also help to dampen the pendulum oscillations in the liquid. A typical arrangement is shown in Figure 1.

5.8.2 U-Tube Arrangement

5.8.2.1 A U- tube arrangement may be used as an alternative to a pendulum. The following are to be complied with in such cases:

.1 The vertical ends of the U-tube should be securely positioned as far outboard as possible. The vertical ends are to be long enough to ensure that at maximum inclinations the water level will neither overflow nor disappear from the vertical ends. Fixed arrangements are to be made for recording all readings at both ends. Clear plastic tube or hose is to be used throughout in order to check for air pockets. A small amount of ink or dye may be added to the water in the device for improved visibility. A typical arrangement is shown in Figure 2.



5.9 Marking

5.9.1 A signboard indicating the following is to be permanently displayed onboard on the craft at a prominent location, after completion of the stability test.

- Maximum number of persons allowed on-board
- Operational restrictions (if any)
- Certification number
- Manufacturer's name and details.

5.10 Sea Trials

5.10.1 A sea trial is to be carried out for each craft to verify maneuvering capabilities at operating speed, reverse and stopping capabilities, course stability at maximum speed when small rudder angles are given to each side of the craft, and operation of the craft is satisfactory. The trials are normally to be carried out in both light condition and fully loaded condition.

5.11 Series of Crafts

5.11.1 A 'series of crafts' means manufacture of more than one craft, under the same manufacturer and agreement; using the same approved plans/ documents, under IRS surveys, and fully complying with IRS requirements covering the production phase.

5.11.2 In case of series of crafts, complete stability test is to be conducted for the first craft and the same may be exempted for the next four crafts (of the series) subject to the following:

- all conditions in 5.11.1 are complied with;
- buoyancy material provided and its arrangement is the same as provided for the first craft;
- number of persons, type of equipment, fuel oil capacity etc. is identical to the first craft; and
- the lightweight deviation between the first craft and any in the series of crafts does not exceed $\pm 2\%$ of lightweight of the first craft.

5.11.3 For the sixth craft in the series, complete stability tests as carried out for the first craft are to be repeated and for the next four in the series, practical test may be exempted in accordance with Sec 5.11.2. Similar methodology would be followed for subsequent series of crafts.

5.11.4 If any craft in the series does not comply with Sec 5.11.2, then that craft is to be considered as a first craft and complete stability test is to be conducted. For the subsequent four crafts in that series, practical test may be exempted if they comply with Sec 5.11.2.

5.11.5 In view of Sec.5.11.4, exemption from the practical test as mentioned above will be communicated after completion of the individual craft, satisfactory verification of arrangement on-board and lightweight survey by IRS.

5.11.6 Reporting format for Series of Crafts is placed at Appendix II.

Appendix I

**TEST REPORT FORMAT
(FOR OPEN CRAFTS OF LESS THAN 15 M LENGTH FITTED WITH BOUYANCY MATERIALS)**

A. GENERAL DETAILS	
NAME OF THE CRAFT	
MANUFACTURER'S DETAILS	
TEST DATE & PLACE	

B. PRINCIPAL PARTICULARS	
Length (M) L	=
Breadth (M) B	=
Depth (M) D	=
Operational region/ Class Notation	
Requested no. of persons (Passenger + Crew)	

C. CONDITIONS DURING PRACTICAL TEST	
Wind	Calm & Satisfied <input type="checkbox"/>
	Not Satisfactory <input type="checkbox"/>
Mooring arrangement	Slack & Satisfactory <input type="checkbox"/>
	Not Satisfactory <input type="checkbox"/>
Adequate depth of water should be available for free movement of the craft	Satisfactory <input type="checkbox"/>
	Not Satisfactory <input type="checkbox"/>

D. SEATING ARRANGEMENTS	
Number of seats available for persons on-board	
Seating arrangements	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
E. BUOYANCY MATERIAL	
Buoyancy materials fitted Mention Plan Reference /location :	Fitted and found satisfactory <input type="checkbox"/> Not Fitted <input type="checkbox"/>
Buoyancy materials requirements Mention type of Material used:	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
F. DECK ARRANGEMENTS	
Deck with Non-skid surface arrangements Rail and holding points for the persons to hold during voyage	Provided and found satisfactory <input type="checkbox"/> Not Fitted <input type="checkbox"/>
G. DRAINAGE ARRANGEMENTS	
Direct overboard drainage is to be provided with a non-return arrangement	Fitted and found satisfactory <input type="checkbox"/> Not Applicable <input type="checkbox"/>
H. WEATHERTIGHT/WATERTIGHT INTEGRITY	
Weathertight/ watertight integrity	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
I. BALLAST ARRANGEMENTS	
Ballast arrangement and Securing (if provided) Mention total ballast weight: Mention type of ballast :	Fitted and found satisfactory <input type="checkbox"/> Not Applicable <input type="checkbox"/>

J. WEIGHT OF THE CRAFT			
Lightweight (Include ballast weight if provided)		=	kg
Total equipment weight Mention Identified equipment on board: Total fuel oil Capacity :		=	kg
Displacement in fully loaded condition Δ (Lightweight + Total <i>equipment</i> weight + Total fuel oil + Total requested persons weight)		=	kg
K. FREEBOARD AT LOADED CONDITION			
Prior to freeboard measurement, weights representing equipment, total fuel oil & total persons* are to be located at their respective positions. (* Per person weight should not be considered less than 75 kg)		Satisfactory	<input type="checkbox"/>
		Not Satisfactory	<input type="checkbox"/>
	Port side (a) (mm)	Star board side(b) (mm)	Minimum from both side (c) (mm)
Freeboard at Aft (mm) "Fa"			
Freeboard at mid (mm) "Fm"			
Freeboard at fwd. (mm) "Ff"			
Mean of minimum Freeboard (c) obtained (Ff + Fm + Fa) / 3		=	mm
Mean freeboard required (F) mean freeboard, F, is not to be less than: F = 200 B mm for mono-hull craft = 100 B/ 0.5 (x/b + 1) mm for catamarans , where x is the gap/ separation between the two demi-hulls [m] at maximum beam of craft and b is the demi-hull breadth at this location [m] ; or F min = 200 mm.		=	mm
Mean freeboard required <= Mean Freeboard obtained		Satisfactory	<input type="checkbox"/>
		Not Satisfactory	<input type="checkbox"/>
Craft is to have a freeboard aft of not less than: Fa = 0.8 x F		=	mm
Aft freeboard obtained		=	mm
Aft freeboard required <= Aft Freeboard obtained		Satisfactory	<input type="checkbox"/>
		Not Satisfactory	<input type="checkbox"/>

L. VERIFICATION OF HEEL ANGLE	
Type of equipment using for the verification of heel angle	PENDULUM <input type="checkbox"/> U-TUBE <input type="checkbox"/>
Pendulum/ U-tube Length	= mm
Pendulum/ U-tube arrangement	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
\$ Maximum Pendulum / U-tube deflection allowed for 10 degree	(0.17632 x length of the Pendulum/U-tube) = mm
<i>\$ The maximum deflection value is to be marked in red on the marking strip near the Pendulum/U-tube, prior to the starting of the test.</i>	
M. STABILITY IN INTACT CONDITION	
IN LIGHT SHIP CONDITION	
Heeling weight required P = 20 x n kg (n = number of persons), or P min = 40 kg.	= Kg
B/2	= mm
Test The heeling weight is to be placed at the gunwale at the maximum beam of the craft, and not less than B/2 from the centerline.	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
Verify <ul style="list-style-type: none">• Heel angle is not exceed 10 degree during test• No water is to enter the craft during test.	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/> HEEL ANGLE = degree

IN MAXIMUM LOAD CONDITION	
Total weights representing equipment and fuel oil are to be located at their respective positions.	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
Heeling weight required $P = 75 \times n$ kg (n = total number of persons).	= Kg
B/4	= mm
Test The weight is to be located on the floor as near to the gunwale as possible, but minimum B/4 from centerline and with longitudinal position corresponding to the arrangement of the accommodation.	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
Verify <ul style="list-style-type: none">• Heel angle is not exceed 10 degree during test• No water is to enter the craft during test.	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/> HEEL ANGLE = degree
Heeling for determination of GM in max load condition (Recommended)	
Heeling weight used for determination of GM, P	= Kg
Location of heeling weight from centreline, d	= m
Heel angle θ (to be not more than 4 degrees)	= deg
$GM = (P \cdot d) / (\Delta \cdot \sin \theta)$	= m
N. BUOYANCY IN FLOODED CONDITION	
Total weights representing equipment and fuel oil is to be located at their respective positions.	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
Weights representing total persons* is to be located at their respective positions. (*Per person weight should be considered not less than 75 kg)	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
Additional weight: P = 25 x n kg (n = total number of persons), but not less than the larger of P = 50 + 50 (L – 2.5) kg, or Pmin = 75 kg.	= Kg

Test	In maximum load condition with additional weight the craft should be flooded in a condition in which it cannot be filled with more water.	Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
Verify	Craft should not sink and is to float approximately horizontal in maximum loaded condition with additional weight loaded	Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
O. STABILITY IN FLOODED CONDITION			
	Total weights representing equipment and fuel oil are to be located at their respective positions.	Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
	Weights representing total persons are to be located at their respective positions.	Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
	Additional weight: PK = 10 + 5 x n kg (n = total number of persons), or PKmin = 25 kg	=	Kg
Test	In maximum load <u>flooded craft</u> condition with additional weight located anywhere along the gunwale and the craft is to comply with the stability requirement.	Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
Verify	Craft should not capsize when additional weight added anywhere along the gunwale	Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
P. TESTING / SEA TRIAL (FOR CRAFTS PROPELLED BY AN ENGINE)			
	This is to verify maneuvering capabilities at operating speed, reverse and stopping capabilities, course stability at maximum speed when small rudder angles to each side of the craft, view from the helmsman's position and operating of the craft is satisfactory. The testing is normally to be carried out in both light condition and fully loaded condition.	REQUIRED YES <input type="checkbox"/>	NO <input type="checkbox"/>
		Satisfactory <input type="checkbox"/>	Not Satisfactory <input type="checkbox"/>
Q. CONCLUSION			
	Final number of persons allowed as per the test (Minimum number of persons satisfactory from the test)		

R. COMMENTS / FINDINGS OF THE ATTENDING SURVEYOR DURING TEST (IF ANY)	
<i>Presented/ Offered by Owner/ Manufacturer's Representative (Company Name, Representative Name and signature)</i>	<i>Witnessed by IRS Attending Surveyor (Name and signature)</i>

Appendix II

**REPORT FORMAT FOR SERIES OF CRAFTS
(FOR OPEN CRAFTS OF LESS THAN 15 M LENGTH FITTED WITH BOUYANCY
MATERIALS)**

A. GENERAL DETAILS	
NAME OF THE CRAFT	
MANUFACTURER'S DETAILS	
TEST DATE & PLACE	

B. PRINCIPAL PARTICULARS	
Length (M) L	=
Breadth (M) B	=
Depth (M) D	=
Operational region/ Class Notation	

C. DETAILS OF THE FIRST CRAFT	
First craft details	
First craft's Practical test conducted on	
Maximum number of Persons allowed for first craft.	

D. SERIES			
Second Craft	<input type="checkbox"/>	Fourth Craft	<input type="checkbox"/>
Third Craft	<input type="checkbox"/>	Fifth Craft	<input type="checkbox"/>

E. CRAFT DETAILS	
Subject craft complies with the requirement as per Sec 5.11 to be considered as series craft.	Yes <input type="checkbox"/> No <input type="checkbox"/>
Buoyancy material provided and its arrangement is as per the first craft.	Yes <input type="checkbox"/> No <input type="checkbox"/>
Number of persons, type of equipment, fuel oil capacity etc. is same as per the first craft.	Yes <input type="checkbox"/> No <input type="checkbox"/>
F. WEIGHT OF THE CRAFT	
Lightweight of the first craft (Include ballast weight if provided) (as per the practical test report of the first craft)	= <input type="text"/> kg
Lightweight of the subject craft (Include ballast weight if provided)	= <input type="text"/> kg
Percentage deviation between First Craft and the subject craft (Weight of the first craft – weight of the subject craft)/ weight of the first craft x 100	= <input type="text"/> %
Percentage deviation obtained Deviation allowed is ± 2 %	Satisfactory <input type="checkbox"/> Not Satisfactory <input type="checkbox"/>
Practical test for the subject vessel may be exempted as per Sec 5.11.	Yes <input type="checkbox"/> No <input type="checkbox"/>
G. CONCLUSION	
Final number of persons allowed for the subject craft (Minimum number of persons satisfactory from the first craft practical test)	
Presented/ Offered by Owner/ Manufacturer's Representative (Company Name, Representative Name and signature)	Witnessed by IRS Attending Surveyor (Name and signature)

End of Classification Note