RUSSIAN MARITIME REGISTER OF SHIPPING

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RULES

FOR THE CLASSIFICATION AND CONSTRUCTION OF HIGH-SPEED CRAFT

PART III

EQUIPMENT, ARRANGEMENTS AND OUTFIT

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RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF HIGH-SPEED CRAFT

Rules for the Classification and Construction of High-Speed Craft of Russian Maritime Register of Shipping (RS, the Register) have been approved in accordance with the established approval procedure and come into force on 1 March 2023.

The present edition of the Rules is based on the 2018 edition taking into account the amendments developed immediately before publication.

The procedural requirements, unified requirements, unified interpretations and recommendations of the International Association of Classification Societies (IACS) and the relevant resolutions of the International Maritime Organization (IMO) have been taken into consideration.

The Rules are published in the following parts:

Part I "Classification";
Part II "Hull Structure and Strength";
Part III "Equipment, Arrangements and Outfit";
Part IV "Stability";
Part V "Reserve of Buoyancy and Subdivision";
Part VI "Fire Protection";
Part VII "Machinery Installations";
Part VIII "Systems and Piping";
Part IX "Machinery";
Part X "Boilers, Heat Exchangers and Pressure Vessels";
Part XI "Electrical Equipment";
Part XII "Refrigerating Plants";
Part XIII "Materials";
Part XIV "Welding";
Part XV "Automation";
Part XVI "Live-Saving Appliances";
Part XVII "Radio Equipment";
Part XVIII "Navigational Equipment";
Part XIX "Signal Means";
Part XX "Equipment for Pollution Prevention";
Part XXI "Craft for Personnel Transportation".

REVISION HISTORY

(Purely editorial amendments are not included in the Revision History)

For this version, there are no amendments to be included in the Revision History.

1 GENERAL

1.1 Definitions and explanations relating to general terminology are given in 1.1 of Part I "Classification" of the Rules for the Classification and Construction of High-Speed Craft[1] and in Part III "Equipment, Arrangements and Outfit" of the Rules for the Classification and Construction of Sea-Going Ships[2].

1.2 For the purpose of this Part the following definition has been adopted:

W e a t h e r t i g h t means that water will not penetrate into the ship in any wind and wave conditions up to those which are meant by critical design conditions.

[1] Hereinafter referred to as "these Rules".
[2] Hereinafter referred to as "the Rules for the Classification".

2 RUDDER AND STEERING GEAR

2.1 Every high-speed craft[1] shall have a reliable device capable to ensure its steering and course-keeping qualities in all operational modes.

2.2 Air or water rudders, foils, flaps, tilting propellers or nozzles, openings which control keeping a steady course or side thrusters may be used as such devices. Course control may be effected by changing the propeller thrust or the geometrical form of the craft or by combination of both.

2.3 In case of interaction between course control systems and stabilization systems or where dual function elements are provided on craft, the requirements of Part XV "Automation" of these Rules shall be met.

2.4 The dimensions of the steering gear main elements shall be determined by calculation or shall be based on model tests. Calculations or materials for model tests shall be submitted to the Register together with documentation on the steering gear. Calculations shall be made for the maximum speeds in two modes of operation — displacement and operational modes.

2.5 At least hydrodynamic loads (force, torque) acting on the rudder shall be taken into account in the calculations with an accuracy acceptable for the Register. Maximum values of hydrodynamic forces and torque which are likely to occur within the range of accepted angles of putting the rudder over from one side to the other shall be used as design loads. Materials proving that the accepted values are actually the maximum values shall be submitted to the Register.

2.6 Where only hydrodynamic loads are taken into consideration as external loads in strength calculations, the reduced stresses in the design sections of the steering gear components shall not exceed 0,5 times the upper yield stress. The specific pressure on supports shall not be more than that given in Table 2.6.

Table 2.6

Material of the pair in friction	Specific pressure p, MPa	
	in backwash	outside backwash
Stainless steel — bronze	—	7,0
Stainless steel — rubber	6,0	8,0
Stainless steel — kaprolon	—	6,0

2.7 The dimensions of the steering gear main components of HSC in the displacement mode shall meet the requirements of Part III "Equipment, Arrangements and Outfit" of the Rules for the Classification.

2.8 Methods for determination of the required propulsive performance of steering gear are not regulated by the Register, and appropriate calculations are not subject to approval by the Register. The above performance is verified by the Register for compliance with the requirements of 2.9 — 2.12 only during sea trials of the craft.

2.9 Steering gear, their controls and actuating systems shall comply with the requirements of Part IX "Materials", Part XI "Electrical Equipment" and Part XV "Automation" of these Rules.

2.10 There shall be provided the main steering gear and auxiliary steering gear. The auxiliary steering gear is not required in case a craft is fitted with several rudders and the steering gear allows to shift each rudder independently of other rudders.

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[1] Hereinafter referred to as "HSC".

2.11 The main steering gear shall be capable of putting the rudder over from 10° on one side to 10° on the other side in not more than 15 s, with the craft running in the operational mode at the maximum speed.

2.12 The auxiliary steering gear shall be capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 s, with the craft running in the displacement mode at a speed of 7 knots.

2.13 The rudder arrangement shall be provided with a system of rudder stops permitting the rudder to be put over on either side only to an angle $\beta°$:

$$(\alpha° + 1°) \leq \beta° \leq (\alpha° + 1{,}5°)$$

where $\alpha°$ is the maximum angle of putting the rudder over, for which the steering gear control system is adjusted but not more than 15° in the operational mode and not more than 35° in the displacement mode; the greater angle of putting the rudder over in both modes, based on the rudder gear design shall be substantiated by the designer and verified by the full-scale trials.

Transition (switching over) from one system of rudder stops to the other shall be automatic depending on the rotation speed of the engines which corresponds to the operational or displacement mode.

2.14 All directional control systems shall be operated from the craft's operating station. If directional control systems can also be operated from other positions, then two-way communication shall be arranged between the operating station and these other positions.

2.15 Adequate indications shall be provided at the operating station and these other positions to provide the person controlling the craft with verification of the correct response of the directional control device to this demand, and also to indicate any abnormal responses or malfunction. The indications of steering response or rudder angle indicator shall be independent of the system for directional control.

3 ANCHOR ARRANGEMENT

3.1 Each HSC shall be provided with anchor arrangement consisting of at least one anchor, anchor wire rope (chain cable), machinery for dropping and hoisting the anchor, and holding the craft at anchor, as well as a stopper for securing the anchor in the hawse pipe.

Where the weight of the anchor is less than 25 kg, anchor machinery may be omitted. In such case, the craft shall be provided with a device for securing the anchor wire rope (chain cable) for riding the craft at anchor.

3.2 The mass of each bower anchor, in kg, shall be not less than that determined by the following formula:

$$Q = 1{,}75N_e \tag{3.2}$$

where N_e is the equipment number according to 3.2 of Part III "Equipment, Arrangements and Outfit" of the Rules for the Classification.

If a high holding power anchor is used as the bower anchor, the mass of the anchor may amount to 75 % of the anchor mass determined by Formula (3.2).

Where the super high holding power anchors are used, the mass of each anchor shall amount to at least 50 % of the anchor mass determined by Formula (3.2)

3.3 The length of the anchor wire rope (chain cable) for the bower anchor, in m, shall not be less than that determined by the following formula:

$$l = 7{,}5\sqrt{Q} + 20 \tag{3.3}$$

where Q = anchor mass, in kg.

3.4 The breaking strength F_{st}, in kN, of the anchor wire rope (chain cable) shall not be less than:

$$F_{st} = 0{,}06kQ \tag{3.4}$$

where k = holding power factor of the used anchor equal to:
3,0 – for normal holding power anchors;
6,0 – for high holding power anchors;
12,0 – for super high holding power anchors;
Q = anchor mass, in kg.

3.5 Ends of a wire rope shall be spliced into sockets, clamps or thimbles. The wire rope shall be connected with the anchor shackle by the joining shackle.

3.6 The craft not fitted with anchor machinery may be provided with synthetic fibre ropes instead of wire ropes (chain cables). The breaking strength F_{syn}, in kN, of the synthetic fibre rope shall be not less than

$$F_{syn} = 0{,}124\delta_{av}F_{st}^{8/9} \tag{3.6}$$

where δ_{av} = average relative elongation in breaking a synthetic fibre rope, in %, but not less than 30 %;
F_{st} = breaking strength of the wire rope as a whole determined by the Formula (3.4), in kN.

3.7 The end of the synthetic fibre rope shall be spliced into a thimble and secured to the anchor, if possible, by a wire rope (chain cable) section having a length equal to at least the distance between the anchor (in stowed for sea position) and the anchor machinery, which complies with the requirements of 3.4 and 3.5.

The length of the wire rope (chain cable) section may be included in the required length of the rope determined by Formula (3.3).

3.8 Laying of an anchor wire rope (chain cable) shall provide its free run when dropping or hoisting the anchor.

The design of the spaces containing anchor recovery equipment shall provide safety of persons using the equipment.

Special attention shall be paid to the means of access to such spaces, the walkways, the illumination and protection against the cable and recovery machinery.

3.9 Adequate arrangements shall be provided for two-way telephone communication between the operating compartment and persons engaged in dropping, hoisting or releasing the anchor.

3.10 The craft shall be protected so as to minimize the possibility of damaging the structure by the anchor and chain cable under all operational conditions.

4 MOORING AND TOWING ARRANGEMENTS

4.1 Each HSC shall be supplied with mooring arrangement for warping to a coastal or floating berth.

4.2 The number of mooring lines on HSC shall be not less than that determined by the following formula:

$$n = 1{,}5 + 0{,}004N_e \tag{4.2}$$

where n= number of mooring lines;
N_e= equipment number according to 3.2 of Part III "Equipment, Arrangements and Outfit" of the Rules for the Classification.

The results of calculations using Formula (4.2) shall be rounded off to both sides to the nearest figure. In all cases, the number of mooring lines shall not be less than two.

4.3 The length of each mooring line l, in m, shall not be less than 1,5 times the length of the craft with rounding off to the nearest 5 m. With $N_e \geq 500$ the length of a mooring line may be taken equal to $1{,}2L$ (where L is the length of HSC, in m).

4.4 The breaking strength, in kN, of wire ropes as a whole shall not be less than that obtained from the following formula:

$$F = 4{,}9\sqrt{N_e}. \tag{4.4}$$

4.5 Mooring lines may be of steel wire, natural fibre or synthetic fibre material. The breaking strength of synthetic fibre ropes shall not be less than that obtained from the following formula:

$$F_{syn} = 0{,}074\delta_{av}F^{8/9} \tag{4.5}$$

where δ_{av} = average relative elongation in breaking a synthetic fibre rope, in %, but not less than 30 %;
F= breaking strength of the wire rope as a whole determined by Formula (4.4), in kN.

Irrespective of the breaking strength regulated by formulae (4.4) and (4.5), mooring lines made of natural fibre or synthetic fibre material less than 20 mm in diameter shall not be used. For the craft with equipment number $N_e \leq 450$ the use of ropes of smaller diameter is allowed, when the designer proves by calculation the sufficiency of mooring rope strength in operational conditions.

Adequate storage place for mooring lines shall be provided such that they are readily available and reliably secured.

4.6 The number and position of mooring and towing bollards, fairleads and other mooring equipment depend on their constructional features, purpose and a need to provide safe berthing.

4.7 Towing arrangements shall be provided to enable HSC to be safely towed in the worst intended conditions. Other arrangements on the craft may be used for towing purposes. The safe speed at which the craft may be towed shall be determined during delivery trials of the first craft of a series.

4.8 Mooring and towing arrangements shall be designed and secured so that watertight integrity of the craft is not impaired in case of their damage.

Provision shall be made to prevent the towing cable being damaged when under load.

4.9 The maximum permissible speed at which the craft may be towed shall be included in the operational manual.

5 SIGNAL MASTS

5.1 The requirements of this Section apply only to masts intended for carrying navigation lights, daytime signalling lamps and other signal means as well as for installation of radio communication and direction-finder aerials.

5.2 Arrangement, height and equipment installed on signal masts shall comply with the requirements of Part XIX "Signal Means" of these Rules.

5.3 If collapsible signal masts are used on HSC and their mass is 40 kg and more, special machinery shall be installed for their operation or provision shall be made for their connection with other deck machinery. The machinery drive may be hand-operated provided the machinery is of a self-braking type, and the load on the handle is not more than 160 N at any moment of jack-knifing or hoisting the mast.

5.4 Masts on HSC may be of any profile with one or several supports; if necessary they may have arrangements for temporary hoisting signal means. The calculation of such masts shall be based on the assumption that each part of the mast is affected by horizontal force F_i, in N:

$$F_i = \frac{1{,}5G_i(Z_i+1)}{T^2} + 0{,}4G_i + PA_i \qquad (5.4)$$

where G_i =mass of the part, in kg;
Z_i = elevation of the centre of gravity of each part above that of the craft, in m;
T = period of craft natural oscillations, in s;
A_i = lateral area of the mast part, in m2;
P = wind specific pressure, in Pa, obtained from the formula

$$P = 0{,}31(V_s + 22)^2$$

where V_s = maximum speed in the operational mode, in m/s.

5.5 Under the loads specified in 5.4 stresses in the parts of masts shall not exceed 0,8 times the yield point of their material where they are made of metal, and 12 MPa where they are made of wood (wood shall be of the first grade).

6 ARRANGEMENT AND CLOSURE OF OPENINGS IN HULL, SUPERSTRUCTURES AND DECKHOUSES

6.1 By the term "watertight deck" is meant a deck or a structure bounding the volumes included in the reserve of buoyancy in compliance with 2.2 of Part V "Reserve of Buoyancy and Subdivision" of these Rules.

6.2 Closures of openings in the watertight deck shall be watertight in case the spaces located on this deck are flooded with water up to the lower edge of windows or side scuttles.

6.3 If in case of flooding the spaces referred to in 6.2, stability and buoyancy of the craft will be considered unsatisfactory by the Register, the closures in such spaces shall be weathertight. Strength of the closures shall be verified by the designer by calculations and tests.

6.4 Side scuttles located below the watertight deck shall be of normal non-opening type with rigid glazing head and fitted with efficient deadlights.

Their arrangement on craft, structure and securing shall comply with 7.2 of Part III "Equipment, Arrangements and Outfit" of the Rules for the Classification.

6.5 Portable shields (one shield for every two or three windows or side scuttles) shall be provided for each type and size of windows or side scuttles located in spaces referred to in 6.2.

Where closures of windows or side scuttles are not covered by the requirement in 6.3, the strength of portable shields shall be calculated for the loads referred to in 5.4.6.2 of Part II "Hull Structure and Strength" of these Rules. The stresses in the shield members shall not exceed the yield point and its construction shall not lose stability.

Portable shields may not be provided if the structure strength of these windows or side scuttles is equal to that of the bulkhead, in which they are installed.

6.6 Windows and side scuttles in passenger and crew accommodation spaces shall be made of a material which will not break into dangerous fragments if fractured.

6.7 When secured, covers of tank manholes shall be tight under the effect of the inner pressure up to the top of the air pipe both for water and liquid cargoes or stores for which they are intended.

6.8 The first craft of each series shall undergo full-scale trials under the worst intended conditions.

6.9 The front and, where necessary, side windows of the wheelhouse or operating compartment shall be provided with means or devices for maintaining satisfactory vision during operation in conditions of glass misting, spray or splashes, icing. The means shall be arranged so that failure of one of them cannot interfere with the ability of the operating crew to watch navigation situation and to steer the craft.

6.10 Outer openings of baggage rooms and special-purpose spaces shall be provided with weathertight closures.

7 ARRANGEMENTS AND EQUIPMENT OF CRAFT SPACES. MEANS OF ESCAPE

7.1 GENERAL

7.1.1 Public spaces and crew accommodation shall be designed and arranged so as to protect the occupants from unfavourable environmental conditions and to minimize the risk of injury to occupants in normal and emergency conditions.

7.1.2 Spaces accessible to passengers shall not contain controls, electrical equipment, high-temperature parts and pipelines, rotating assemblies or other items, from which injury to passengers could result, unless such items are adequately shielded, isolated, or otherwise protected.

7.1.3 Public spaces shall not contain operating controls unless the operating controls are protected and located so that their operation by a crew member shall not be impeded by passengers in normal and emergency conditions.

7.1.4 The public spaces, crew accommodation and the equipment therein shall be designed so that each person making proper use of these facilities will not suffer injury during craft's normal and emergency start, stop and manoeuvring in normal cruise and in failure or maloperation conditions.

7.2 PUBLIC ADDRESS AND INFORMATION SYSTEM

7.2.1 A general emergency alarm system shall be provided. The alarm shall be audible throughout all the public spaces, corridors and stairways, crew accommodation and normal crew working spaces and open decks. The sound pressure level shall be at least 10 dB(A) above ambient noise levels under way in normal cruise operation. The alarm shall continue to function after it has been triggered until it is normally turned off or is temporarily interrupted by a message on the public address system.

7.2.2 A public address system shall cover all areas where passengers and crew have access, escape routes, and places of embarkation into survival craft. The system shall be such that flooding or fire in any compartment does not render other parts of the system inoperable. The public address system and its performance standards shall be approved by the Register.

7.2.3 All passenger craft shall be equipped with illuminated or luminous notices or video information system(s) visible to all sitting passengers, in order to notify them of safety measures.

7.2.4 The master of the craft shall, by means of the public address system and the visual information system, be able to request passengers "please be seated" when found to be appropriate to safeguard passengers.

7.3 DESIGN ACCELERATION LEVELS.

7.3.1 Special precautions shall be taken with respect to passenger safety provided superimposed vertical accelerations at longitudinal centre of gravity of the craft are above 1,0g.

7.3.2 Passenger craft shall be designed for collision design acceleration g_{coll} with respect to the safety in, and escape from, the public, crew accommodation spaces and escape routes, including lifesaving appliances and emergency source of power. The size and type of craft together with speed, displacement and building material shall be taken into consideration when collision load is determined. The collision design condition shall be based on head-on impact at a defined collision speed.

7.3.3 Mounting of large masses such as main engines, auxiliary engines, lift fans, transmissions and electrical equipment shall be proved by calculation to withstand, without fracturing, the design acceleration given in Table 7.3.3.

Table 7.3.3

Design acceleration as multiples of g

Direction	Types of craft	
	All HSC except amphibious ACVs	Amphibious ACVs
Forward direction	g_{coll}	6
After direction	2 or g_{coll} if less	3
Transverse direction	2 or g_{coll} if less	3
Vertical direction	2 or g_{coll} if less	3
g_{coll}= the collision design acceleration expressed as a multiple of the acceleration due to gravity (9,806 m/s^2).		

7.3.4 Collision design acceleration g_{coll} (for craft other than amphibious ACVs where $g_{coll} = 6$) shall be determined by the formula

$$g_{coll} = 1{,}2(P/g\Delta) \leq 12 \qquad (73.4\text{-}1)$$

The load *P* shall be taken as the lesser of P_1 and P_2*:*

$$P_1 = 460(MC_L)^{2/3}(EC_H)^{1/3}; \qquad (7.3.4\text{-}2)$$

$$P_2 = 9000MC_L(C_H\mathrm{D})^{1/2} \qquad (7.3.4\text{-}3)$$

where M is the hull material factor taken as:

M= 1,3 for high-tensile steel;

M= 1,00 for aluminium alloy;

M= 0,95 for mild steel;

M= 0,8 for fibre-reinforced plastics;

C_L= the length factor determined from the formula:

$$C_L = \frac{(165+L)}{245}\left\{\frac{L}{80}\right\}^{0,4} \qquad (7.3.4\text{-}4)$$

C_H= the height factor determined from the formula:

$C_H = (80 - L)/45$ but not greater than 0,75 or less than 0,3;

E = the kinetic energy of the craft at speed V_{imp} equal to:

$$E = 0{,}5V_{imp}^2$$

where L, D, Δ, V_{imp} and g are the main particulars of the craft:

L= craft length, in m;

D= depth of the craft from the underside of keel to the top of the effective hull girder, in m;

Δ= craft displacement, being the mean of the lightweight and maximum operational weight, in t;

V_{imp}= estimated impact speed, in m/s, equal to two-thirds operational speed;
g= acceleration due to gravity equal to 9,806 m/s^2.

For hydrofoils, the collision design acceleration, g_{coll}, shall be taken as the greater of either the g_{coll} as calculated above or:

$$g_{coll} = F/(g\Delta) \quad (7.3.4\text{-}5)$$

where F = failure load of bow foil assembly applied at the operational waterline, in kN.

7.3.5 As an alternative to the requirements of 7.3.3, the collision design acceleration g_{coll} may be determined by carrying out collision load analysis of the craft on a vertical rack having a maximum height of 2 m above the waterline and using the same assumption for displacement Δ and impact speed V_{imp} as described in 7.3.4. This evaluation may be carried out as part of the safety analysis. If the collision design accelerations are determined by both the formula given in 7.3.4 and the collision load analysis, the lower resulting value may be used as the collision design acceleration.

7.3.6 Limiting sea states for operation of the craft shall be given in normal operation condition and in the worst intended conditions, at operational speed and at reduced speed as necessary.

7.4 ACCOMMODATION DESIGN

7.4.1 The public spaces, control stations and crew accommodation of the high-speed craft shall be located and designed to protect passengers and crew in the design collision condition. In this respect, these spaces shall not be located forward of a transverse plane (refer to Fig. 7.4.1) such that

$$A_{bow} = 0{,}0035AmfV, \text{ but never less than } 0{,}04A$$

where A_{bow} = the plan projected area of the craft energy absorbing structure forward of the transverse plane, in m^2;

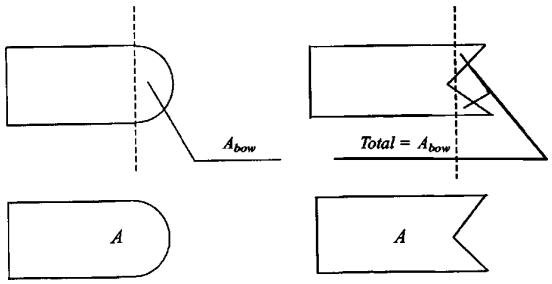

Fig. 7.4.1
Plan view of two different craft styles

A= total plan projected area of the craft, in m^2;
m= material factor = 0,95/M;
M= appropriate hull material factor as given in 7.3.4. Where materials are mixed, the material factor m shall be taken as a weighted mean weighted according to the mass of material in the area defined by A_{bow};
f = framing factor as follows:
f = 0,8 — longitudinal deck and shell stiffening;
f = 0,9 — mixed longitudinal and transverse framing;
f = 1,0 — transverse deck and shell stiffening;
V = operational speed, in m/s.

7.4.2 The public spaces and crew accommodation shall be designed based on the guidelines given in Table 7.4.2 or by other methods approved by the Register, which have been proven to give equal protective qualities.

Table 7.4.2

Guidelines on general design characteristics[1]

Design level 1: g_{coll} less than 3	
1	Seat/seat belts
1.1	Low or high seatback
1.2	No restrictions on seating direction
1.3	Sofas allowed
1.4	No seat belts requirements
2	Tables in general allowed
3	Padding of projecting objects
4	Kiosks, bars, etc — no special restrictions
5	Baggage — no special requirements
6	Large masses — restrainment and location in certain position

Design level 2: g_{coll} = 3 to 12	
1	Seat/seat belts
1.1	High seatback with protective form and padding
1.2	Forward or backward seating direction
1.3	No sofas allowed as seat
1.4	Lap belt in seats when no protective structure in front
2	Tables with protective features allowed. Dynamic testing
3	Padding of projecting objects
4	Kiosks, bars, etc — on aft side of bulkheads, or other specially approved arrangements
5	Baggage placed with protection in front
6	Large masses — restrainment and location in certain position
[1] Other means may be used which ensure equal safety level.	

7.4.3 Equipment and baggage in public spaces and in the operator's compartment shall be positioned and secured so that they remain in the stowed position when exposed to collision design acceleration according to 7.3.4 and 7.3.5 and Table 7.3.3.

7.4.4 Seats, life-saving appliances and items of substantial mass and their supporting structure shall not deform or dislodge under any loads up to those specified 7.3.4 and 7.3.5 and Table 7.3.3 in any manner that would impede subsequent rapid evacuation of passengers.

7.4.5 There shall be adequate handholds on both sides of any passage to enable passengers to steady themselves while moving around.

7.5 SEATS CONSTRUCTION

7.5.1 A seat shall be provided for each passenger and crew member.

7.5.2 Seats fitted in addition to those required in 7.5.1 and which are not permitted to be used in hazardous navigational situations and potentially dangerous weather or sea conditions need not comply with 7.5 or 7.6. Such seats shall be secured according to 7.4.4 and it shall be clearly identified that they are not permitted for use in hazardous situations.

7.5.3 The installation of seats shall be such as to allow adequate access to any part of the accommodation space. They shall not obstruct access to any essential emergency equipment or means of escape.

7.5.4 Seats and their attachments, and the structure in proximity of the seats, shall have a form, design and construction such as to minimize the possibility of injury and to avoid trapping of passengers after the assumed damage in the collision design conditions according to 7.4.1. Dangerous projections and hard edges shall be eliminated or padded.

7.5.5 Seats and adjacent parts such as tables shall be designed for the collision design acceleration as specified in 7.3.4.

7.5.6 All seats, their supports and their deck attachments shall have good energy-absorbing characteristics and shall meet the requirements of Appendix.

7.6 SAFETY BELTS

7.6.1 One-hand-release belts of three-point type or belts with shaller harness shall be provided for all seats from which the craft may be operated for all craft with collision design acceleration g_{coll} exceeding $3g$ (refer to 7.3.4).

7.6.2 Safety belts shall be provided for passenger seats and, if necessary, for crew members seats to ensure safety as specified in Appendix.

7.7 EXITS AND MEANS OF ESCAPE

7.7.1 Easy, safe and quick access from the operating compartment to passenger accommodation spaces shall be provided. In order to ensure immediate assistance of the crew in an emergency situation, the crew accommodation spaces, including cabins, shall be located with due regard to easy, safe and quick access to public spaces.

7.7.2 The craft design shall be such that all occupants may safely evacuate the craft into survival craft under all emergency conditions, by day and by night. The positions of all exits, which may be used in an emergency, and of all life-saving appliances, the practicability of the evacuation procedure, and the evacuation time to evacuate all passengers and crew shall be demonstrated.

7.7.3 Public spaces, means of escape, exits, lifejackets stowage places, survival craft stowage places, and the embarkation stations shall be clearly and permanently marked and illuminated as required in Part XI "Electrical Equipment" of these Rules.

7.7.4 Each enclosed public space and similar permanently enclosed space allocated to passengers or crew shall be provided with at least two exits as widely separated as practical. All exits shall clearly indicate the directions to the evacuation station and safe areas. On category A craft and cargo craft, at least one exit shall give access to the evacuation station serving the persons in the enclosed space considered, and all other exits shall give access to a position on the open deck from which access to an evacuation station is provided. On category B craft, exits shall provide access to the alternative safe area required by 2.5.4 of Part VI "Fire Protection" of these Rules; external routes may be accepted providing that the requirement of 7.7.3 and 7.7.11 are complied with.

7.7.5 Subdivision of public spaces to provide refuge in case of fire may be required in compliance with the requirements 2.3.1 and 2.5.4 of Part VI "Fire Protection" of these Rules.

7.7.6 Exit doors shall be capable of being readily operated from inside and outside the craft in daylight and in darkness. The means of operation shall be obvious, rapid and of adequate strength. Doors along escape flow shall, wherever appropriate, open in the direction of escape flow from the space served.

7.7.7 The closing, latching and locking arrangements for exits shall be such that it is readily apparent to the appropriate crew member when the doors are closed and in a safe operational condition, either in direct view or by an indicator. The design of external doors shall be such as to minimize the possibility of jamming by ice or debris.

7.7.8 The craft shall have a sufficient number of exits, which are suitable to facilitate the quick, and unimpeded escape of persons wearing approved lifejackets in emergency conditions, such as collision damage or fire.

7.7.9 Sufficient space for a crew member shall be provided adjacent to exits for ensuring the rapid evacuation of passengers.

7.7.10 All exits, together with their means of opening, shall be adequately marked for the guidance of passengers. Adequate marking shall also be provided for the guidance of rescue personnel outside the craft.

7.7.11 Footholds, ladders, etc., provided to give access from the inside to exits shall be of rigid construction and permanently fixed in position. Permanent handholds shall be provided whenever necessary to assist persons using exits, and shall be suitable for conditions when the craft has developed any possible angles of list and trim.

7.7.12 At least two unobstructed evacuation paths shall be available for the use of each person. Evacuation paths shall be disposed such that adequate evacuation facilities will be available in the event of any likely damage or emergency conditions. Evacuation paths shall have adequate lighting supplied from the main and emergency sources of power.

7.7.13 The width of corridors, doorways and stairways which form part of the evacuation paths shall be not less than 900 mm for passenger craft and 700 mm for cargo craft. This width may be reduced to 600 mm for corridors, doorways and stairways serving spaces where persons are not normally employed. There shall be no protrusions in evacuation paths, which could cause injury, ensnare clothing, damage lifejackets or restrict evacuation of disabled persons.

7.7.14 Adequate notices shall be provided to direct passengers to exits.

7.7.15 Provision shall be made on board for embarkation stations to be properly equipped for evacuation of passengers into life-saving appliances. Such provision shall include handholds, anti-skid treatment of the embarkation deck, and adequate space, which is clear of cleats, bollards and similar fittings.

7.7.16 Main propulsion machinery spaces and roro spaces shall be provided with two means of escape leading to a position outside the spaces from which a safe route to the evacuation stations is available. One means of escape from the main propulsion machinery spaces shall avoid direct access to any ro-ro space. Main propulsion machinery spaces having a length of less than 5 m and not being routinely entered or continuously manned, may be provided with a single means of escape.

7.8 BAGGAGE ROOMS, STORES AND CARGO COMPARTMENTS

7.8.1 Provision shall be made to prevent shifting of baggage, stores and cargo compartment contents, having due regard to occupied compartments and acceleration likely to arise. If safeguarding by positioning is not practicable, adequate means of restraint for baggage, stores and cargo shall be provided. Shelves and overhead shelves for storage of carry-on baggage in public spaces shall be provided with adequate means to prevent luggage from falling out in any conditions that may occur.

7.8.2 Controls, electrical equipment, high-temperature parts, pipelines or other items, the damage or failure of which could affect the safe operation of the craft or which may require access by crew members during a voyage, shall not be located in baggage, store and cargo compartments unless such items are adequately protected so that they cannot be damaged or operated inadvertently by loading, by unloading or by movement of the contents of the compartment.

7.8.3 Loading limits, if necessary, shall be durably marked in those compartments.

7.8.4 Having regard to the purpose of the craft, the closures of the exterior openings of the baggage and cargo compartment as well as special category spaces shall be appropriately weathertight.

8 GUARD RAI IS, BULWARKS

8.1 Guard rails or bulwarks shall be fitted on all exposed parts of decks to which crew or passengers have access. Alternative arrangements such as safety harnesses and jack-stays may be accepted if they provide an equivalent level of safety. The height of the bulwarks or guard rails shall be at least 1 m from the deck. Where this height would interfere with the normal operation of the craft, it may be lessened within the context of the crew and passengers' safety review provided.

8.2 The opening below the lowest course of the guard rails shall not exceed 230 mm. The other courses shall be not more than 380 mm apart. In case of craft with rounded gunwales the guard rail supports shall be placed on the flat of the deck.

8.3 Satisfactory means (in the form of guard rails, life lines, gangways or underdeck passages, etc.) shall be provided for the protection of the crew in getting to and from their quarters, the machinery space and all other parts used in the necessary work of the craft.

8.4 Deck cargo carried on any craft shall be so stowed that any opening which is in way of the cargo and which gives access to any space used in the work of the craft can be properly closed and secured against the admission of water. Effective protection for the crew in the form of guard rails or life lines shall be provided above the deck cargo if there is no convenient passage on or below the deck of the craft.

9 EMERGENCY OUTFIT

9.2 Emergency outfit shall be stored at least in two emergency stations, one of which shall be in the machinery space. Emergency stations may be special places, boxes or places allocated on deck or in spaces. In the emergency station of the machinery space the outfit necessary for carrying out the emergency operations inside the space shall be stored; the rest of emergency outfit shall be stored in the emergency stations located above the bulkhead decks. On ships of less than 45 m in length it is allowed to locate the emergency station below the bulkhead deck on condition that free access to the station is provided. On ships 31 m in length and below it is allowed to store emergency outfit only in one emergency station.

9.3 A free passage shall be provided in front of the emergency station; the width of the passage shall be selected depending on the overall dimensions of the outfit stored in the station but not less than 0,8 m. On ships 31 m in length and less, the width of the passage may be reduced to 0,6 m.

Passages to emergency stations shall be straight and short as far as practicable.

9.4 Items of emergency outfit (other than collision mats) or cases for their storage shall be painted blue either entirely or in stripes. Cases for emergency equipment shall have a distinct inscription showing the name of the material, weight and warranted storage period.

9.5 Emergency stations shall be provided with distinct inscriptions "Emergency station". In addition, notices showing location of the emergency station shall be posted in passages and on decks.

9.1 The provision of emergency outfit shall be determined by the shipowner based on a structural type of HSC and conditions of its operation.

APPENDIX

CRITERIA FOR TESTING AND EVALUATION OF REVENUE AND CREW SEATS

1. PURPOSE AND SCOPE

1.1 This Appendix shall provide requirements for revenue and crew seats, seat anchorage and seat accessories and their installation to minimize occupant injury and/or obstacles for evacuation of people if the craft suffers a collision.

2. STATIC SEAT TESTS

2.1 The requirements of this Section are applicable to all crew and revenue seats.

2.2 All seats to which this Section applies, along with their supports and deck attachments, shall be designed to withstand at least the following static forces applied in the direction of the craft:

.1 forward direction — a force of 2,25 kN;

.2 after direction — a force of 1,5 kN;

.3 transverse direction — a force of 1,5 kN;

.4 vertically downward — a force of 2,25 kN;

.5 vertically upward — a force of 1,5 kN.

A seat shall comprise a frame, bottom and back. Forces applied in the fore or aft direction of the seat shall be applied horizontally to the seat back 350 mm above the seat bottom. Forces applied in the transverse seat direction shall be applied horizontally to the seat bottom. Vertical upward forces shall be evenly distributed to the comers of the seat bottom frame. Vertical downward forces shall be uniformly distributed over the seat bottom. If a seating unit consists of more than one seating position, these forces shall be applied at each seating position concurrently during the tests.

2.3 When the forces are applied to a seat, consideration shall be given to the direction in which the seat shall face in each craft. For example, if the seat faces sideways, the transverse craft force is applied fore and aft to the seat and the forward craft force is applied transversely to the seat.

2.4 Each seating unit to be tested shall be attached to the support structure similar to the manner in which it will be attached to the deck structure in the craft. Although a rigid support structure can be used for these tests, a support structure, having the same strength and stiffness as the support structure in the craft, is preferred.

2.5 The forces described in 2.2.1 to 2.2.3 shall be applied to a seat through a cylindrical surface having a radius of 80 mm and a width at least equal to the width of the seat. The surface shall be equipped with at least one force transducer able to measure the forces applied.

2.6 The seat shall be considered acceptable if:

.1 under the influence of the forces referred to in 2.2.1 to 2.2.3, the permanent displacement measured at the point of application of the force is not more than 400 mm;

.2 no part of the seat, the seat mountings or the accessories become completely detached during the tests;

.3 the seat remains firmly held, even if one or more of the anchorages is partly detached;

.4 all of the locking systems remain locked during the entire test but the adjustment and locking systems need not be operational after the tests; and

.5 rigid parts of the seat with which the occupant may come into contact shall present a curved surface with a radius of at least 5 mm.

2.7 The requirements of Section 3 may be used in lieu of the requirements of this section provided that the accelerations used for the tests are at least 3g.

3. DYNAMIC SEAT TESTS

3.1 The requirements of this Section are applicable in addition to those in 2.1 for crew and revenue seats in craft having a design collision load of *3g* or greater.

3.2 All seats for which this Section applies, the seat supporting structure, the attachment to the deck structure, the lap belt, if installed, and shaller harness, if installed, shall be designed to withstand the maximum acceleration force that can be imposed upon them during a design collision. Consideration shall be given to the orientation of the seat relative to the acceleration force (i. e. whether the seat is forward-, aft-, or side-facing).

3.3 The acceleration pulse to which the seat is subjected shall be representative of the collision timehistory of the craft. If the collision time-history is not known, or cannot be simulated, the acceleration timehistory envelope shown in the figure can be used.

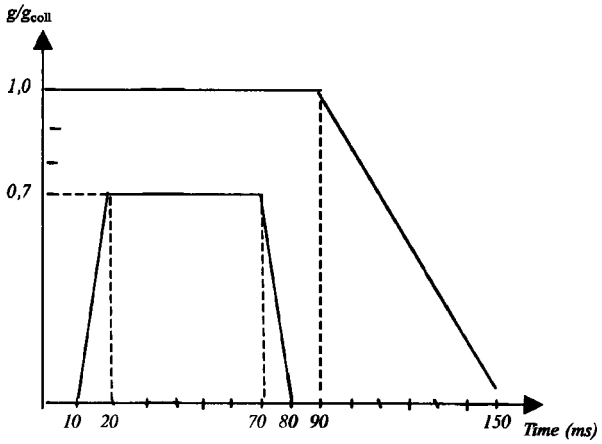

Fig. 3.3
Acceleration time-history envelope

3.4 In the test frame, each seat unit and its accessories (e. g., lap belts and shaller harnesses) shall be attached to the support structure similar to the manner in which it will be attached in the craft. The support structure can be a rigid surface; however, a support structure having the same strength and stiffness as the support structure in the craft is preferred. Other seats and/or tables with which the occupant may come in contact during a collision shall be included in the test frame in orientation and with a method of attachment typical of that in the craft.

3.5 During the dynamic seat test, a dummy suitable for the test being conducted and corresponding by main dimensions to the fiftieth percentile of human body dimensions, shall be placed in the seat in an upright seating position. If a typical seating unit is composed of more than one occupant seat, a test dummy shall be placed in each occupant seat in the unit. The dummy, or dummies, shall be secured in the seat unit in accordance with procedures of recognized by the Register and be secured using only the lap belt and shoulder harness if they are installed. Tray tables and other such devices shall be placed in the position that would cause the greatest potential for an occupant to become injured.

3.6 The test dummy shall be instrumented and calibrated in accordance with the requirements of a recognized national standard, so as to permit, as a minimum, calculation of the head injury criterion, calculation of the thoracic trauma index, measurement of force in the femur, and measurement, if possible, of extension and flexion of the neck.

3.7 If more than one dummy is used in the tests, the dummy located in the seat having the highest potential for an occupant to be injured shall be the one instrumenied. The other dummy or dummies need not be instrumented.

3.8 The tests shall be conducted and the instrumentation shall be sampled at a rate sufficient to reliably show response of the dummy in accordance with the requirements of standard ISO 6487.

3.9 The seat unit tested in accordance with the requirements of this Section shall be considered acceptable if:

.1 the seat unit and tables installed in the seat unit do not become dislodged from the supporting deck structure and do not deform in a manner that would cause the occupant to become trapped or injured;

.2 the lap belt, if installed, remains attached and on the test dummy's pelvis during the impact. The shaller harness, if installed, remains attached and in the immediate vicinity of the test dummy's shaller during the impact. After the impact, the release mechanisms of any installed lap belt and shaller harness shall be operative;

.3 the following acceptability criteria are met:

.3.1 the head injury criterion (HIC), calculated in accordance with the formula, does not exceed 500:

$$HIC=(t_2-t_1)\left[\frac{1}{t_2-t_1}\int_{t_1}^{t_2}a(t)dt\right]^{2,5}$$

where t_1 and t_2 are the beginning and ending time (in seconds) of the interval in which the HIC is a maximum. The term $a\ (t)$ is the resultant measured acceleration in the head of the dummy, in g;

.3.2 the thoracic trauma index (TTI), calculated in accordance with the formula, does not exceed 30 g except for periods totalling less than 3 ms:

$TTI = \frac{g_r - g_{ls}}{2}$ or acceleration at the center of gravity

where g_r is the acceleration, in g, of either upper or lower rib;
g_{ls} is the acceleration, in g, of lower spine;

3.3 the force in the femur does not exceed 10 kN except that it cannot exceed 8 kN for periods totalling more than 20 ms;

.4 loads on the upper torso harness straps do not exceed 7,8 kN or a total of 8,9 kN if dual strap are used.

Russian Maritime Register of Shipping

Rules for the Classification and Construction of High-Speed Craft
Part III
Equipment, Arrangements and Outfit

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