RUSSIAN MARITIME REGISTER OF SHIPPING

RULES
FOR THE CLASSIFICATION AND CONSTRUCTION OF TYPE A WIG CRAFT

St. Petersburg
2000

Rules for the Classification and Construction of Type A WIG Craft have been approved in accordance with the current Regulations and come into force on 1 January 1999.

The Rules have been developed on the basis of Rules for the Classification and Construction of Sea-Going Ships, 1995, Rules for the Equipment of Sea-Going Ships, 1995, Rules for Safety for Dynamically Supported Craft, 1990, Requirements for Technical Supervision of Small Ships, 1988, International Code of Safety for High-Speed Craft adopted by IMO Resolution MSC.(36)63, 20 May 1994 and basic provisions of International Draft Code of Safety for WIG Craft (document IMO DE 40/11/1).

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INTRODUCTION

1. International conventions ratified in respect of conventional ships, International Code of Safety for High-Speed Craft[1], and regulations applied as a consequence of such conventions can not be applied to WIG craft having super-high relative speeds in the main mode of operation which means flying of WIG craft near to free water surface.

The necessity to provide safety levels of these ships not lower than those of displacement ships or conventional high-speed craft and understanding that improvement of hull strength will result in an unjustified increase in its mass and power output of main engines with no guarantee of passengers and crew safety in case of collision required the development of new approaches to safety, the elaboration of Rules for the Classification and Construction of Type A WIG Craft[2].

2. When elaborating the Rules the following concept provisions of Type A WIG craft[3] operation as a high-speed transport means with dynamically supported principles have been accepted:

.1 WIG craft principal mode of operation is flying over water or other supporting surface (ground) in the zone of aerodynamic influence of this surface.

.2 WIG craft are designed so that they cannot increase their flight altitude outside the limits of the ground effect in any manoeuvres and under any external effects in normal operation.

.3 WIG craft have amphibious qualities being capable of travelling over land, ice, snow, etc.

.4 WIG craft are capable of getting over land gradients in order to come out on to specially equipped sites or a sloping shore/bank for loading/unloading operations, berthing, small repairs, maintenance, refuelling as well as getting off such sites.

.5 Transition to principal mode of operation and back under normal operating conditions is always brought about on water surface. For amphibian WIG craft transition to amphibious mode and back may be brought about over a surface which is not water surface.

.6 Seaworthiness of WIG craft depends on its size and is mainly limited by the weather conditions (wind and sea state) consistent with the safe take-off and water landing.

.7 WIG craft operation safety is additionally provided by its natural stability within a sufficiently wide range of changing heel and trim angles, flight altitude and operational speed as well as by WIG craft ability of water landing while in any flight phase or of independently coming on a flat shore/bank or getting off a flat shore/bank to water.

.8 To provide WIG craft with the heightened take-off, landing and amphibious performances, gas jets of the main propulsion engines or those of the additional propulsion engines may be directed under the wings to produce additional weight unloading the WIG craft by means of increasing the air pressure in the zone between the bottom of the craft and the ground (static air cushion).

.9 To provide for WIG craft coming ashore and for lower overloads when taking off from or landing on rough seas, various damping devices may be installed on the bottom and the intermediate vertical plates of the craft.

.10 WIG craft have an operational speed significantly greater than that of conventional ships and current high-speed craft. As a result, all ships may be considered as stationary objects when compared to WIG craft, which makes the manoeuvring of conventional ships to avoid collision with WIG craft ineffective. Therefore, when flying in the principal mode of operation as well as in taking off and landing, steps must be envisaged in advance to avoid interfering in the navigation of other ships.

.11 In all waterborne modes of operation, WIG craft are subject to the rules of International Regulations for Preventing Collisions at Sea, 1972.

.12 WIG craft have no means of going astern. This should be taken into account in steering and sailing. Hard breaking is effected, if necessary, in the flying mode of operation, by landing on the water, by stopping or turning on the water or by other safe methods.

.13 Safety of WIG craft after damage when moving on water is to be ensured by structural, organizational and technical measures consistent with the basic principles of Rules for Safety for Dynamically Supported Craft[4] and the HSC Code. Damages to WIG craft because of collisions with an obstacle while in the airborne mode are not considered and are to be prevented by providing WIG craft with appropriate technical means of timely obstacle detection, change of flight altitude and direction, landing on the water and manoeuvring in the horizontal plane, etc as well as through organizational and technical measures.

3. No provision of the Rules may be a reason impairing further development of WIG craft. The Rules are subject to revision and updating with obtaining experience of their application in design, construction and operation of WIG craft.

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[1] Hereinafter referred to as "the HSC Code".
[2] Hereinafter referred to as "the Rules".
[3] Hereinafter referred to as "WIG craft".
[4] Hereinafter referred to as "the Rules for DSC".

GENERAL

SECTION 1. SCOPE OF APPLICATION

1.1 The Rules apply to Type A WIG craft[1] with power output of the engines more than 55 kW, which:

.1 carry not more than 12 passengers, on condition that all passengers are provided with seats;

.2 in the course of their voyage do not proceed more than 20 miles from the shore and more than 100 miles from the place of refuge;

.3 are operated only during daytime;

.4 have the maximum operating mass not more than 10 tons.

1.2 The scope of requirements for WIG craft which are not covered by 1.1 is specified by Russian Maritime Register of Shipping[2] in each particular case.

1.3 Unless stipulated otherwise by the Rules, General Regulations for the Supervision apply to WIG craft as far as they are applicable to such ships.

1.4 Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft as far as it is specified in each part of the Rules.

1.5 The requirements of the Rules apply to WIG craft which were under construction or in service on the date of the Rules coming into force as far as it is reasonable and practicable.

SECTION 2. DEFINITIONS AND EXPLANATIONS

For the purpose of the Rules the following definitions have been adopted:

Damping device is a device designed to reduce the vertical overloads incident to the take-off and landing modes of operation of WIG craft and to provide amphibious qualities thereto.

Amphibious mode is a special mode of amphibious WIG craft when it moves over a surface which is not the water surface (e.g., land, ice, snow, marsh, etc).

Base port is a specific port identified in the route operational manual and provided with:

access to facilities provided with appropriate rescue and survival equipment;

access to WIG craft maintenance services with appropriate equipment.

Displacement mode is the regime, whether at rest or in motion, when the weight of WIG craft is fully or predominantly supported by hydrostatic forces.

Displacement of a light ship is the displacement of WIG craft in tonnes without cargo, oil fuel, lubricating oil, ballast water, fresh water and feed water in tanks, consumable stores, passengers and crew and their effects.

Wing is a profiled plate or three-dimensional construction designed to create an aerodynamic lift with the ground effect and to form the static and dynamic air cushion.

Altitude of ground effect action is an altitude which is determined by relation of lifting area of a wing (wings) designed for creating the ground effect to its (their) span.

Base port State is the State in which the base port is located.

Length of WIG craft L is the overall length, in metres, of the underwater watertight envelope of the rigid hull.

Flap is an element formed as an integrated part of, or an extension of, a wing, used to adjust the hydrodynamic or aerodynamic lift of the wing.

Weathertight means that in any sea conditions water will not penetrate into the ship.

Significant wave height is the average height of the one-third highest observed wave heights over a given period.

Critical design conditions are the specified limited conditions, chosen for design purposes, which WIG craft are to keep in displacement mode. Such conditions are to be more severe than the worst intended conditions by a suitable margin to provide for adequate safety in the survival condition.

Maximum speed is the speed achieved in the flying mode at the maximum continuous propulsion power at maximum operational weight and in smooth water.

Maximum operational weight is the overall weight up to which operation of WIG craft in the ground effect mode is permitted by the Register.

Type A WIG craft is a high-speed ship covered by 1.1 which weight in the principal service (ground effect) mode is mainly supported by an aerodynamic lift developed at a wing (wings) utilizing the effect resulting from the proximity of water surface or some other supporting surface (ground effect) and not intended for operation beyond the altitude of ground effect action.

Machinery spaces are spaces containing internal-combustion engines with aggregate total power output of more than 55 kW, generators, oil fuel units, propulsion machinery, major electrical machinery and similar spaces and trunks to such spaces.

[1] According to the IMO classification given in International Draft Code of Safety for WIG craft (DE 40/1/11).

[2] Hereinafter referred to as "the Register".

Muster station is an area where passengers can be gathered in case of emergency, given instructions and prepared to abandon WIG craft, if necessary. The passenger spaces may serve as muster stations if all passengers can be instructed there and prepared to abandon WIG craft.

Place of refuge is any naturally or artificially sheltered aquatorium which may be used as a shelter by WIG craft under conditions likely to endanger its safety.

Worst intended conditions are the specified environmental conditions within which the intentional operation of WIG craft is provided for in the Classification Certificate. This is to take into account such parameters as the worst conditions of wind force allowable, significant wave height (including unfavourable combinations of length and direction of waves), minimum air temperature, visibility and depth of water for safe operation and such other parameters as the Register may require in considering the type of WIG craft in the area of operation.

Stabilizing device is a device creating forces necessary for stabilization and control of WIG craft in the space (rudders and elevators, flaps and ailerons, pivoting pylons, etc).

Passenger is every person other than:

the master and members of the crew or other persons employed or engaged in any capacity on board WIG craft on the business of that craft; and

a child under one year of age.

Transitional mode is the regime between displacement and skimming modes.

Flight is WIG craft running over the water after take-off from the water or other surface.

Control stations are spaces in which WIG craft radio or navigating equipment or the emergency source of power and emergency switchboard are located, or where fire recording or fire control equipment is centralized, or where other functions essential to the safe operation of WIG craft, such as propulsion control, public address, stabilization system, etc, are located.

Continuously manned control station is a control station which is continuously manned by a responsible member of the crew while WIG craft is in the mode of normal operation.

Designed altitude in waves is the flight altitude in the ground effect mode with the service speed and in waves corresponding to the worst permitted conditions; this is specified in documentation.

Designed altitude in calm water is the flight altitude in the ground effect mode with the service speed in calm water; this is specified in documentation.

Skimming mode is the mode of normal operation of WIG craft on water surface by which the craft weight is supported essentially or mainly by hydrodynamic forces.

Take-off/landing mode is the transient mode from the skimming to the ground effect mode.

Operating compartment is the enclosed area from which the navigation and control of WIG craft is exercised.

Skeg is a vertical or inclined profiled plate or a volumetric construction which is attached to the air wing or made as its part and which serves for decreasing the inductive aerodynamic resistance and for limitations of static and dynamic air cushions.

Flashpoint is a flashpoint determined by a test using the closed-cup apparatus referenced in International Maritime Dangerous Goods (IMDG) Code.

Breadth of a WIG craft B is breadth, in metres, of the broadest part of the moulded watertight envelope of the rigid hull.

Ground effect mode is the main operation mode of flying of WIG craft near to free water surface or to other supporting surface in the range of altitude of he "ground effect" action.

Operational speed is 90% of the maximum speed.

SECTION 3. CONDITIONS OF SAFETY

3.1 The required level of safety of WIG craft in service is provided by fulfilment of the requirements of the Rules regulating safety by technical means provided on board of WIG craft in combination with organizational and technical measures described in the Annex to the Rules.

A complex of organizational and technical measures is to be provided by a shipowner.

SECTION 4. GENERAL REQUIREMENTS

4.1 The first WIG craft of a series is to be tested according to a programme approved by the Register, which includes inspections in the scope which is sufficient for confirmation of reliability of WIG craft and safety of its operation under the worst intended conditions.

The programme is to provide for testing the behaviour of WIG craft, its machinery and systems in case of simulations of emergency situations, failures, errors in control approved by the Register as well as for determination, if necessary, of external loads for which structures are calculated. Such tests are to be

carried out in the presence of a Surveyor to the Register.

4.2 Based on the test results, critical design conditions (wave height, wind velocity, etc) under which the WIG craft may move in the displacement mode in forced circumstances according to good marine practice are to be specified. Such parameters and recommendations on control in the displacement mode are to be indicated in the operational manual.

4.3 All cases of impairing WIG craft stability, i.e. abnormal angles of heel and trim, loss of controllability and other abnormal facts in WIG craft behaviour are to be reported by the shipowner to the Regional Office of the Register in charge of supervision.

4.4 Any substitution of materials, machinery, instruments and other equipment subject to supervision by the Register is to be agreed with the Register.

4.5 The Register may exempt WIG craft from complying with a requirement of the Rules provided it will be proved that it hinders further improvement of WIG craft. In this case, the level of safety not lower than that provided by the Rules is to be ensured.

4.6 In case WIG craft where some requirements of the Rules are not met is intended for international voyages, the level of safety is to be recognized as adequate by the Register and Administration of the country at the ports of which WIG craft will call.

SECTION 5. DOCUMENTS

5.1 Classification Certificate, Safety Equipment Certificate and Seaworthiness Certificate are issued by the Register to every WIG craft flying the flag of the Russian Federation.

5.2 The Classification Certificate is the document which confirms the fulfilment of the requirements of Parts I to XV of the Rules. The worst intended conditions under which WIG craft motion in the ground effect mode is permitted, parameters of critical design conditions, maximum distance allowed to proceed from the shore and places of refuge, and other limitations, where necessary, are to be indicated in the Classification Certificate.

5.3 The Safety Equipment Certificate is the document which confirms compliance with the requirements set forth in Part XVI "Life-Saving Appliances, Signal Means, Radio Equipment and Navigational Equipment".

5.4 The documents referred to in 5.1 are issued for one year.

5.5 Confirmation of Shipowner's Readiness for Operation of WIG Craft (see Annex) which is to be submitted by the shipowner to the Register is the document which confirms complex fulfilment by the shipowner of the organizational and technical measures. The Confirmation is subject to annual renewal.

5.6 In case some organizational and technical measures referred to in the Annex is not taken, the Confirmation becomes invalid.

The Confirmation of Shipowner's Readiness for Operation of WIG Craft is to be renewed after elimination of the reasons because of which the previous Confirmation has lost its validity.

5.7 If all the documents referred to in 5.1 and 5.5 are available, the Seaworthiness Certificate is issued by the Register to each WIG craft.

A particular route, routes or water area where WIG craft is allowed to operate with due regard for weather conditions and distance allowed to proceed from the shore and place of refuge as well as other limitations indicated in the Certificates referred to in 5.1 are to be specified in the Seaworthiness Certificate.

5.8 Along with the provisions of 1.4.14 of General Regulations for the Supervision, the Seaworthiness Certificate issued by the Register to WIG craft becomes invalid:

.1 if the Confirmation of Shipowner's Readiness for Operation of WIG Craft has lost its validity;

.2 if the shipowner has not fulfilled the requirements of 4.3 or 4.4.

PART I. CLASSIFICATION

SECTION 1. GENERAL

1.1 The Register may assign a class to WIG craft after construction or may assign or renew the class to WIG craft in service.

1.2 Assignment of the Register class means that the Register confirms that WIG craft complies with the requirements imposed thereupon and is taken under Register supervision for a specified period of time.

1.3 Class renewal means that the Register confirms that technical condition of WIG craft is consistent with the class assigned and that the Register supervision is prolonged for a certain period of time.

1.4 WIG craft class is assigned or renewed by the Register for a period of one year but in sound cases, the Register may assign or renew the class for some other period of time.

1.5 If WIG craft has the valid class of the Register, it means that WIG craft is under the Register supervision, as provided in the Rules, over its technical condition and meets fully or to the extent considered adequate by the Register the requirements of the Rules applicable thereto according to the craft purpose, service conditions and class notation. WIG craft class is confirmed by the valid Classification Certificate.

1.6 The Classification Certificate ceases to be valid and the class is suspended in the following cases:

in case WIG craft was not submitted to the mandatory survey within the prescribed period of time;

after an accident, provided it will not be submitted for a survey in the port where the accident took place or at the first port it calls after the accident;

after structural alterations not agreed with the Register and changes in WIG craft outfit;

after repair carried out without the Register supervision;

if the weight of WIG craft exceeds the maximum operational weight or service conditions do not meet the appropriate requirements to be complied with for the assignment of the particular class.

1.7 Where cases referred to in 1.6 are discovered as well as in cases when WIG craft is taken out of service by the shipowner for a long time required to fulfil the requirements imposed by the Register for renewal or confirmation of the class or for any other reason, the Register Head Office may take a decision to suspend the class for a period of up to six months. In this case, survey of WIG craft for confirmation or renewal of the class may be carried out only if permitted by the Register Head Office within the scope agreed with the Register.

1.8 Class withdrawal means that the Register ceases its supervision if renewal or suspension of the class is considered impossible by the Register. The class may be withdrawn at the shipowner's desire.

1.9 Class cancellation means cessation of the Register supervision of WIG craft because of its loss or scrapping.

SECTION 2. CLASS NOTATION OF TYPE A WIG CRAFT

2.1 The character of classification of WIG craft built according to the Rules and under the Register supervision is to be **KM⊛**.

2.2 If WIG craft as a whole or its hull or its machinery installation, machinery and equipment were built according to the Rules and under the supervision of another classification body recognized by the Register and then WIG craft was classed by the Register, the character of classification is to be **KM★**.

2.3 If WIG craft as a whole or its hull or its machinery installation, machinery and equipment were built without the supervision of a classification body recognized by the Register or without the supervision of any classification body and then the craft was classed by the Register, the character of classification is to be **(KM)★**.

2.4 If a system providing automatic or semi-automatic stabilization is installed on WIG craft, and WIG craft cannot move in the operational mode without the system, letters **Ac** are added to the character of classification.

2.5 The mark of the service area is not indicated in the class notation. The distances from the shore and place of refuge for which WIG craft has been designed are indicated in the Classification Certificate, and the particular route, routes or water area where its operation is permitted are indicated in the Seaworthiness Certificate.

2.6 Where WIG craft meets the requirements of Part V "Reserve of Buoyancy and Subdivision" in case of flooding of any two or three adjacent compartments over the entire length of WIG craft

with the design side damages specified in 4.3, subdivision distinguishing mark 2 or 3, respectively, is added to the character of classification.

2.7 Distinguishing marks are put in the class notation in the following sequence:

.1 character of classification — **КМ⊛, КМ★** or **(КМ)★**;

.2 subdivision distinguishing mark — 2 or 3;

.3 automatic stabilization mark **Ac**;

.4 descriptive notation — WIG craft.

SECTION 3. CLASSIFICATION SURVEYS

3.1 Initial survey.

3.1.1 The initial survey is carried out for the purpose of assigning class to WIG craft which is submitted for classification for the first time or for class renewal of WIG craft which class has been withdrawn. During the initial survey the compliance of WIG craft and its technical condition with the Rules is to be ascertained.

3.1.2 The scope of the survey is in each case determined by the Register in accordance with Table 3.2.2.

3.2 Special survey.

3.2.1 Special survey is carried out for the purpose of class renewal. During the special survey the compliance of the technical condition of WIG craft with its service conditions defined by WIG craft class is to be ascertained.

3.2.2 The scope of special surveys is given in Table 3.2.2.

3.3 Occasional surveys.

3.3.1 Occasional surveys of WIG craft or individual items of machinery, arrangements, installations, equipment or outfit are held when WIG craft are submitted for survey in all cases other than initial and periodical surveys. The scope and procedure of surveys are specified by the Register depending on the purpose of the survey, WIG craft age and technical condition.

3.3.2 A survey of WIG craft after an accident is carried out in case of damage sustained by the craft hull, machinery, arrangements, plants, equipment or outfit subject to technical supervision by the Register.

The survey is to be held in the port which the craft will call at after the accident. The survey aims to find damages, to agree upon the scope of work required to eliminate the consequences of the accident and to determine the possibility and conditions of maintaining the class of the craft.

3.3.3 An occasional survey is held at the request of a shipowner or underwriter in the scope necessary to fulfil their request.

Table 3.2.2

Item of survey	Scope of special survey[1]
Hull structures and buoyancy compartments	OMH
Superstructure or deckhouse	OMH
Seatings of machinery and equipment	OM
Bulwark and/or hand rails	OM
Hatch coamings, hatch covers, doors and side scuttles	OMH
Air or water rudder blade, its bracket	OMH
Rudder trunk	OMH
Rudder stocks, pintles, bearings, connection parts	OM
Steering gear	OM
Anchors, hawse pipes, hawser ports	OM
Anchor chains and ropes	OM
Towing and mooring arrangements (stoppers, bollards, bitts, cleats, fairleads)	C
Structural fire protection, fire fighting means, outfit and tools	C
Internal combustion engines	OMPE
Shafts, gears and couplings, flanged connections	OMP
Propeller	CP
Anchor heaving machinery, winch	OMP
Bilge system with pipes, fittings, pumps	CP
Oil fuel tanks with air pipes, fittings and gauging system	OP
Oil fuel system	CP
Ventilation system	CP
Electric power sources (accumulator batteries, attached generators, diesel-generators)	OMP
Control and signalling boards and panels	OMP
Cabling	OMP
Essential motors, lighting, navigation lights, electric heaters and radiators	OMP
Lightning arresters and anti-lightning earthing	CM
Control, starting and regulating equipment	CMP
Instrumentation	CEP
Automatic stabilization equipment	OMPE

Symbols:
O — examination with provision of access, opening-up and dismantling, where necessary;
C — external examination;
M — measurements of wears, clearances, insulation resistance, etc;
H — pressure tests (hydraulic, pneumatic);
P — functional tests of machinery, equipment and arrangements, their external examination;
E — control of availability of valid documents and/or brands to confirm testing of instruments by appropriate competent bodies, provided they are subject thereto.

[1] For the scope of surveys of life-saving appliances, signal means, radio and navigational equipment, see Table 2.3, Part I "Supervision Regulations" of Rules for the Equipment of Sea-Going Ships.

3.4 Classification of WIG craft classed with another classification body and WIG craft with no class.

3.4.1 The Register may classify WIG craft which has not been classified earlier or which class assigned by another classification body has become invalid, provided WIG craft is submitted for initial survey to assign a class.

3.4.2 WIG craft which holds the valid class of another classification body may be assigned a class of

the Register, provided WIG craft is submitted for initial survey to assign a class. Upon satisfactory results of the survey the Register may assign a class to WIG craft for a period of validity of the Classification Certificate held by the craft.

3.4.3 For the classification of WIG craft holding a class of another classification body or WIG craft which class assigned by another classification body has become invalid, the following documents are to be submitted:

.1 the latest Classification Certificate;

.2 Survey Reports issued by surveyors to a classification body on the surveys carried out from the last special survey for class renewal;

.3 Specification;

.4 general arrangement plan;

.5 midship section;

.6 construction profile;

.7 shell expansion;

.8 watertight bulkhead drawing;

.9 rudder drawings;

.10 approved Stability Information for all the conditions referred to in 1.2;

.11 fire-proof bulkhead drawings;

.12 engine-room general arrangement plan;

.13 shaft and gear drawings;

.14 electric circuit diagrams;

.15 circuit diagrams of main and emergency switchboards;

.16 arrangement plans of communication means, general and fire alarm systems;

.17 longitudinal and local strength calculations of WIG craft hull;

.18 strength calculations and service life provision programme;

.19 calculations of propeller flexural and torsional oscillations or results of full-scale measurements.

3.4.4 When submitting for classification WIG craft with no class assigned, the scope of the documentation to be presented is to be agreed with the Register in each particular case.

3.5 Intervals between periodical surveys.

3.5.1 Intervals between periodical surveys of WIG craft are to be recorded from the date of issuing the Classification Certificate.

3.5.2 Intervals between periodical surveys of WIG craft holding a valid class of another classification body and admitted for classification by the Register are to be recorded from the date of issuing the Classification Certificate by the body which assigned the class to WIG craft.

3.5.3 Intervals between periodical surveys of WIG craft in service are to be recorded from the date of special class renewal survey completion, for which date the date of Classification Certificate issuing is taken.

SECTION 4. TECHNICAL DOCUMENTATION

4.1 Design technical documentation of WIG craft under construction.

4.1.1 General.

Before the beginning of WIG craft construction, design technical documentation proving that the requirements of the Register Rules applicable to the craft are met is to be submitted to the Register for consideration. The documentation is to be presented to the Register in three copies with the lists.

4.1.2 General documentation.

.1 general craft specification (no approval stamps are needed);

.2 general arrangement plans with indication of escape routes;

.3 list of associated equipment and materials with indication of the basic technical data, manufacturer and availability of approval by the Register or another competent body (no approval stamps are needed).

4.1.3 Hull documentation.

4.1.3.1 In case of subsequent approval of working drawings the following documentation is to be submitted:

.1 determination of scantlings of hull members;

.2 midship section plan with the most typical transverse sections with indication of spacing between main longitudinal and transverse members, main particulars of WIG craft and their ratios, class notation of WIG craft;

.3 constructional profile with indication of frame spacings, boundaries of the portions of the craft length, position of watertight bulkheads;

.4 shell expansion: the shell expansion for glass-reinforced plastic WIG craft is to be submitted in case the thickness of the shell plating varies;

.5 drawings of longitudinal and transverse bulkheads;

.6 drawings of seatings of main machinery with bottom construction thereunder and indication of the type and power output of the engine;

.7 calculation of external forces;

.8 longitudinal and local strength calculation;

.9 strength calculation of structures of special arrangements;

.10 service life provision programme;

.11 structural drawings of special arrangements;

.12 drawings of attachment of special arrangements to the hull;

.13 structural drawing of the pylon;

.14 vibration calculations of WIG craft hull, wing, tail unit.

The following documentation is to be submitted additionally:

.15 detailed description of the technological hull constructing process containing information on

materials, methods of forming the structural items, necessary conditions required during hull construction as well as local and general strength analysis of the hull structure (only for glass-reinforced plastic WIG craft);

.16 scheme of hull structures tightness tests;

.17 air cylinder drawings;

.18 programme of mooring tests and sea trials.

4.1.4 Documentation on arrangements, equipment and outfit.

4.1.4.1 In case of subsequent approval of working drawings, the following documentation is to be submitted:

.1 arrangement plan of openings in WIG craft structures;

.2 strength calculation of closing appliances;

.3 general arrangement plan of steering gear, anchor, mooring and towing arrangements;

.4 strength calculation of steering gear and calculations of anchor, mooring and towing arrangements;

.5 calculation of external forces affecting controls;

.6 programme of control reliability provision;

.7 drawings of controls;

.8 scheme, description of method and calculation of passenger evacuation time.

4.1.4.2 With no subsequent approval of working drawings, the following documentation is to be submitted additionally:

.1 list and arrangement of emergency outfit;

.2 programme of mooring tests and sea trials.

4.1.5 Documentation on stability:

.1 lines drawing, coordinate tables of lines drawing;

.2 hydrostatic curves;

.3 curves of areas and static moments of hull cross sections;

.4 calculations and curves of arms of stability;

.5 summary table of displacements, positions of centre of gravity, trim and initial stability for various loading conditions;

.6 materials on stability in all modes which confirm compliance with the requirements of Part V of the Rules;

.7 materials on stability in case of failures in controls, their machinery and machinery power supply systems;

.8 plan of watertight compartments which provide reserve of WIG craft buoyancy;

.9 summary table of the results of stability verification according to the Rules and curves of static or dynamic stability.

4.1.6 Documentation on subdivision:

.1 calculations of damage stability and trim of WIG craft, including static stability curves (no approval stamps are needed);

.2 plan of WIG craft subdivision showing the arrangement of all watertight structures and openings with indication of types of closing appliances.

4.1.7 Documentation on fire protection.

4.1.7.1 In case of subsequent approval of working drawings the following documentation is to be submitted:

.1 arrangement plan of fire-proof divisions (including doors);

.2 elementary diagrams of fire extinguishing systems;

.3 diagrams of fire detection and alarm systems;

.4 calculations of fire extinguishing systems (no approval stamps are needed);

.5 schemes or descriptions of insulation, lining, finishing and deck covering with indication of fire hazard categories of the materials used, as well as calculation of the amount of combustible materials (no approval stamps are needed);

.6 full information on fire hazard categories of new materials used (no approval stamps are needed);

.7 diagram of bunkering, storage and distribution system for oil fuel with a flash point below 43°C;

.8 list of fire fighting outfit.

4.1.7.2 With no subsequent approval of working drawings the documentation referred to in 4.1.7.1 is to be submitted and additionally:

.1 arrangement plan of fire-proof divisions (including doors) with indication of numbers of their Type Approval Certificates or information containing satisfactory results of fire tests required, drawings of items and elements of fire-proof divisions of A and B;

.2 drawings of insulation, linings, and deck coverings;

.3 arrangement plan of fire fighting outfit;

.4 list of spare parts and tools;

.5 programme of mooring tests and sea trials.

4.1.8 Documentation on machinery installations.

4.1.8.1 In case of subsequent approval of working drawings the following documentation is to be submitted:

.1 general arrangement plans of machinery and equipment;

.2 diagram and description of the remote control for main machinery complete with information on equipment of remote control stations with control devices, indication and signalling devices, means of communication and other arrangements;

.3 drawings and strength calculations of gears and shafts;

.4 documents on propeller:

.4.1 propeller general view drawing;

.4.2 drawings of blade, hub and pieces for their attachment;

.4.3 diagrams of propeller control systems and their description;

.4.4 propeller strength calculation.

4.1.8.2 With no subsequent approval of working drawings the documentation referred to in 4.1.8.1 is to be submitted and additionally:

.1 drawings seating and attachment fittings of the main machinery;

.2 list of spare parts;

.3 programme of mooring tests and sea trials.

4.1.9 Documentation on automation equipment.

4.1.9.1 In case of subsequent approval of working drawings the following documentation is to be submitted:

.1 list of systems, devices and elements used in automation systems;

.2 circuit schemes and block diagrams of alarm and warning systems, including diagrams of power supply;

.3 list of controlled parameters with indication of types of devices, manufacturers, data on reliability and the Register approval for devices;

.4 circuit schemes and block diagrams of automation systems for main engines (cooling, lubricating oil, oil fuel preparation systems, etc).

4.1.9.2 With no subsequent approval of working drawings the documentation referred to in 4.1.9.1 is to be submitted and additionally:

.1 circuit schemes and block diagrams of automation systems supervised by the Register and listed in the relevant Parts of the Rules, not mentioned in 4.1.9.1;

.2 programme of mooring tests and sea trials.

4.1.10 Documentation on systems and piping.

4.1.10.1 In case of subsequent approval of working drawings the following documentation is to be submitted:

.1 documentation on craft's systems:

.1.1 bilge system diagram;

.1.2 diagrams of ventilation and air conditioning systems;

.1.3 diagrams of air, overflow and sounding pipes, remote gauging systems for oil fuel tanks;

.1.4 diagrams of hydraulic systems for drives of mechanisms and arrangements;

.1.5 calculation of bilge and ventilation systems in accumulator rooms and enclosed spaces;

.2 documents on machinery installation systems:

.2.1 diagram of oil fuel system;

.2.2 diagram of lubrication oil system;

.2.3 diagram of cooling system;

.2.4 diagram of exhaust gas piping.

4.1.10.2 With no subsequent approval of working drawings the documentation referred to in 4.1.10.1 which is to contain information on materials, insulation, manufacture, assambling, arrangement, hydraulic tests etc is to be submitted and additionally:

.1 exhaust gas piping drawing;

.2 programme of mooring tests and sea trials.

4.1.11 Documentation on electrical equipment.

4.1.11.1 In case of subsequent approval of working drawings the following documentation is to be submitted:

.1 circuit diagrams of electric power generation and distribution from the main and emergency sources of power: craft's mains, lighting (up to section switchboards) and navigation lights;

.2 circuit diagrams and general arrangement plans of main and emergency switchboards, control desks and other switchboards of non-standard design;

.3 calculation results of necessary output of the craft's sources of electrical power (no approval stamps are needed);

.4 calculation results of cross-sections of cables with indication of their types, currents and protection (no approval stamps are needed);

.5 calculation results of illumination intensity for spaces and areas (no approval stamps are needed);

.6 circuit diagrams of outer connections of craft's controls, communication means, and fire detection and alarm systems;

.7 circuit diagrams of essential electric drives according to 1.3.2.1.5, Part XI "Electrical Equipment" of Rules for the Classification and Construction of Sea-Going Ships;

.8 circuit diagram of cable runs with indication of spaces they are laid through;

.9 diagram of the protection earthing on WIG craft with non-metal hull;

.10 drawings of equipment layout and cable laying in dangerous areas and spaces. Documentation (certificates issued by competent bodies) confirming the possibility of using the electrical equipment in dangerous areas and spaces;

.11 capacity calculation results for accumulator batteries of emergency lighting, navigation lights, fire detection and fire smothering systems;

.12 list of all essential electrical equipment installed on WIG craft with indication of technical characteristics and data on approval of the equipment by the Register or another competent body.

4.1.11.2 With no subsequent approval of working drawings, the documentation referred to in 4.1.11.1 is to be submitted and additionally:

.1 drawings of cable runs and their penetrations through watertight bulkheads, decks and platforms;

.2 diagrams of lighting circuits from section switchboards;

.3 list of spare parts;

.4 programme of mooring tests and sea trials;

.5 arrangement and installation drawings of electrical equipment in all spaces and areas of the WIG craft;

.6 assembly drawings (only for non-standard products) of control stations and desks, special boards, power and lighting switchboards;

.7 circuit diagrams of outer connections, arrangement and installation drawings of devices for measuring of non-electrical values (level, pressure, temperature gauges, etc).

4.1.12 Documentation on WIG craft equipment is to be in accordance with Part I "Supervision Regulations" of Rules for Equipment of Sea-Going Ships.

4.2 Technical documentation on WIG craft subject to conversion or reconstruction.

4.2.1 Prior to commencement of work on conversion or reconstruction of WIG craft, technical documentation relating to parts of hull, machinery and equipment subject to conversion or reconstruction is to be submitted to the Register for consideration.

4.2.2 In case new machinery or arrangements are to be installed in WIG craft in service, which differ substantially from those fitted initially and which are to meet the requirements of the Rules, additional technical documentation on new installations, associated machinery or arrangements is to be submitted to the Register for consideration within the scope required for WIG craft under construction (see 4.1).

4.3 Working drawings for WIG craft under construction.

4.3.1 General provisions:

.1 lists of emergency, fire fighting and other outfit with indication of main technical characteristics and positions in WIG craft; lists of spare parts and special tools. The lists are to be submitted for all sections where it is specified by the Rules;

.2 programmes of mooring tests and sea trials.

4.3.2 Hull documentation:

.1 stem and sternframe drawings (if fitted);

.2 drawings of main hull details;

.3 drawings of seatings for main machinery, equipment and arrangements included in the nomenclature;

.4 plan of hull testing for watertightness;

.5 plan of hull subdivision into sections;

.6 description of the basic technological process of joining hull parts based on the methods of carrying out such operations acceptable for the Register.

4.3.3 Documentation on arrangements, equipment and outfit:

.1 general arrangement plans of assemblies and parts of closing appliances in hull;

.2 general arrangement plans of assemblies and parts of steering gear, active means of WIG craft steering, anchor, mooring, towing arrangements, guard rails.

4.3.4 Stability documentation.

Preliminary information on stability and calculations on which it is based (provided the materials are not included in the documentation to be submitted in accordance with 4.1.5).

Preliminary information on stability is to be submitted for consideration to the location of the Register which was involved in examination and approval of the technical design.

4.3.5 Documentation on subdivision.

Preliminary information on emergency trim and stability and calculations on which it is based (provided the materials are not included in the documentation to be submitted in accordance with 4.1.6).

4.3.6 Documentation on fire protection:

.1 arrangement drawing of fire-proof divisions (including doors);

.2 drawings of assemblies and parts of fire-proof divisions;

.3 drawings of insulation, linings and deck coverings;

.4 structural drawings and calculations of separate typical assemblies and equipment of fire fighting and fire alarm systems;

.5 diagrams of fire-extinguishing systems;

.6 fire plans according to 1.4, Part VI "Fire Protection" of Rules for the Classification and Construction of Sea-Going Ships (as far as reasonable and applicable for WIG craft).

4.3.7 Documentation on systems and piping:

.1 drawings of craft's systems:

.1.1 bilge system;

.1.2 oil fuel system;

.1.3 lubricating oil system;

.1.4 cooling system;

.1.5 exhaust gas system;

.1.6 hydraulic system;

.1.7 ventilation system of spaces, construction of dampers and shut-off fittings of ventilation and other openings necessary to ensure fire safety of WIG craft (if any);

.1.8 air, overflow and sounding pipes, systems of remote level sounding of oil fuel tanks.

4.3.8 Documentation on machinery installations:

.1 drawings of installation and attachment of main machinery;

.2 drawings of oil fuel and lubricating oil tanks fittings;

.3 drawings of silencers and spark arresters of exhaust gas pipes;

.4 drawings of gears and shafts;

.5 propeller drawings.

4.3.9 Documentation on automation systems and devices:

Mounting and structural drawings of blocks of automation systems and devices, sensors, alarm devices, instruments as well as of switchboards and desks of control and monitoring.

4.3.10 Documentation on electrical equipment:

.1 diagrams of main and emergency lighting circuits (from section switchboards);

.2 cable installation drawings with indication of their penetrations through watertight bulkheads, decks and platforms;

.3 structural assembly drawings (for non-standard products only) including:

.3.1 switchboards;

.3.2 control stations and desks;

.3.3 special boards;

.4 arrangement and installation drawings and diagrams of devices for measurements of non-electric values (level, pressure, temperature,etc);

.5 arrangement and installation drawings of electrical equipment in all rooms and spaces of WIG craft;

.6 updated drawings and diagrams referred to in 4.1.11.1.

4.3.11 Documentation on WIG craft equipment is to be in accordance with Part I "Supervision Regulations" of Rules for the Equipment of Sea-Going Ships.

4.4 Final (operational) documentation of WIG craft.

4.4.1 Upon completion of construction, testing and commissioning of WIG craft, the final (operational) documentation is to be submitted to the Register for information.

The scope of documentation and procedure of its submitting are to be agreed with the Register.

PART II. HULL

SECTION 1. DESIGN PRINCIPLES

1.1 General.

1.1.1 Scope of application.

.1 This Part of the Rules establishes the requirements and standards which are to be met by WIG craft structures and strength of hulls made of polymer composite materials.

.2 Scantlings ensuring strength of WIG craft hulls and structures which are not regulated by the Rules are subject to special consideration by the Register.

1.1.2 Scope of supervision.

.1 General provisions on supervision are to be in line with 1.3,"General" of the Rules.

.2 All the structures regulated by the present part of the Rules are subject to the Register supervision.

1.1.3 Definitions and explanations.

Definitions and explanations correspond to those given in Part XVI "Hull Structure and Strength of Glass-Reinforced Plastic Ships and Boats" of Rules for the Classification and Construction of Sea-Going Ships.

1.1.4 Symbols:

L = length of WIG craft between perpendiculars, m;

B = breadth of WIG craft, m;

d = draught of WIG craft in calm water without motion, m;

Δ = weight displacement, t;

V = operational speed in water, m/s;

l_0 = distance of WIG craft centre of gravity from the aft perpendicular,m;

I = moment of inertia of WIG craft hull cross-section about the neutral axis, $cm^2 \cdot m^2$;

S = static moment of design cross-section part located above the member considered about the neutral axis, $cm^2 \cdot m$;

m_h = distribution of WIG craft mass along its length, t/m;

$h_{3\%}$ = wave height with 3% probability of exceeding level, m;

h_{max} = maximum wave height (wave height with 0,5% probability of exceeding level), m;

δ = total thickness of the side and longitudinal bulkheads at the level where shear stresses are determined, cm;

s = thickness of a structural member, mm;

a = distance between neighbouring stiffeners (short side of a plate), cm;

l = length of a stiffener, cm;

$g = 9{,}81$ m/cm^2 = gravitational acceleration;

$\rho = 0{,}104 ts^2/m^4$ = water density.

1.2 Design loads.

1.2.1 External loads acting on WIG craft hull and its structures are to be determined by calculation or experimental methods for the most severe service conditions specified in the design technical assignment. Anticipated maximum values of external forces and their moments for the whole service life of WIG craft are assumed as design loads.

1.2.2 Calculation of external forces.

1.2.2.1 The following external forces acting on WIG craft are considered:

.1 aerodynamic forces determined with regard to changes in the motion velocity, effective angles of incidence, effect of blowing as well as likely horizontal and vertical wind gusts;

.2 hydro-aerodynamic and other forces on main planes of the air wing, flaps and air cylinders which arise in contact with a wave or a solid obstacle;

.3 resistance forces because of viscous friction of water or land;

.4 resistance forces of a flap (with regard to damping devices);

.5 propulsive force;

.6 distributed weight force.

1.2.2.2 External forces acting on WIG craft hull and its individual structures are to be determined for the service conditions specified in the technical assignment. The following design conditions are to be considered:

.1 steady straight-line motion in the ground effect mode with different course angles to waves with the design wave height;

.2 motion in the skimming and taking off/landing modes in waves with the design wave height;

.3 steady straight-line motion in the ground effect mode in regular waves under conditions of gusty wind corresponding to the worst intended weather conditions as well as with no wind;

.4 inclinations because of waves and wind corresponding to the critical design weather conditions when moving in the displacement mode at a low speed;

.5 motion in the amphibious mode with coming across various obstacles.

1.2.2.3 The wave surface is considered in two variants:

.1 irregular waves in the form of the following sum of cylindrical waves with a sinusoidal profile of different length and height:

wave packet containing design waves with 0,5% probability of exceeding level and 46% probability of exceeding level:

$$h_{B_{0,5\%}} = 1{,}23 h_{B_{3\%}},$$

$$h_{B_{46\%}} = h_{B_{0,5\%}} - \Delta h,$$

where $h_{B_{3\%}}$ = wave height with 3% probability of exceeding level;
Δh = exceedance of the wave to be obtained from the following formula:

$$\Delta h = 0{,}75 h_{B_{3\%}},$$

and regular waves with wave height $h_B = 0{,}8 h_{B_{3\%}}$;

.2 two-dimensional waves calculated using the spectral method.

1.2.2.4 Several variants regarding magnitude and direction of wind gust action specified in the technical assignment are considered.

1.2.2.5 Types of obstacles when moving on the ground: shore ledge, tussock, ditch.

1.2.2.6 Determination of design forces for verification of general strength of WIG craft structure.

.1 In determining design forces for verification of general strength of WIG craft structure, the dynamic response of WIG craft to the external disturbance is considered as the balanced system of all external forces including mass and inertia forces.

.2 Dynamic loading is represented in the form of curves of the extreme values of the following design parameters:

.2.1 distribution of vertical and horizontal overloads along WIG craft length in the longitudinal and lateral directions;

.2.2 curves of bending moments and shear forces because of dynamic loads in case of longitudinal bending (sagging, hogging), lateral bending (sagging, hogging) and twisting of WIG craft structure as a whole;

.2.3 curves of bending and twisting moments and shear forces about the axis of the wing stiffness;

.2.4 curves of bending moments and shear forces about the axis of the aft wingl stiffness;

.2.5 curves of bending moments and shear forces about the axis of the keel stiffness in the planes of the least and greatest stiffness;

.2.6 curves of bending moments and shear forces on the brackets of the air cylinder;

.2.7 curves of bending moments and shear forces of the forward part of WIG craft when bending in the vertical and horizontal planes;

.2.8 curves of bending moments, shear forces and torque on the bracket of the transmission.

1.2.2.7 Determination of design forces for verification of local strength of WIG craft structure.

.1 In order to check local strength of the lower plane of the wing and flap, the hydrodynamic loads acting in the modes where contacts with wave surface exist are to be determined:

.1.1 hydrodynamic pressure on the lower plane of the wing in case of a flat impact against water because of skimming forces. The impact spot moves depending on the speed, angles of trim (pitching) and heel;

.1.2 hydrodynamic pressure on the flap within the range of angles of deviations provided for by the piloting methods;

.1.3 hydrodynamic pressure on the retractable rudder box.

.2 Determination of aerodynamic pressure:

.2.1 aerodynamic pressure on the cabin is to be determined in accordance with the standards on airworthiness of the civil aviation;

.2.2 average aerodynamic pressure on lifting surfaces of WIG craft is determined in the ground effect mode under gust wind conditions (gust velocity is to be specified in the technical assignment) as well as in the displacement mode or amphibious mode without motion (when at berth) with the specified wind gust.

1.2.2.8 External loads determined using an accepted calculation procedure are considered to be operational loads. In order to obtain design values, safety factor $f = 1{,}5$ is introduced.

1.2.2.9 The calculated loads are to be made more accurate and corrected according to the results of sea trials of the first WIG craft of the series, on the basis of which operational limitations are to be finally specified.

1.3 Strength.

1.3.1 Requirements for strength.

.1 These standards on strength establish the requirements for strength calculation and verification of strength of WIG craft hull structures and special arrangements. Compliance with these standards is mandatory in design, construction and renovation of WIG craft.

.2 Deviations from these strength standards or use of other standards for calculation of the main structures may be only allowed on agreement with the Register in case of adequate substantiation confirmed by experimental verification and operation of WIG craft.

.3 Strength calculations made in accordance with these standards are to be accessible for comprehensive verification of all initial data contained therein. Computer-aided calculations are to be made according to the programmes which have Type Approval Certificate of the Register. The Register may require check calculations based on any programme.

The Register does not check the correctness of computer operations in calculations, including those made in accordance with the programmes having Type Approval Certificate of the Register.

.4 Strength calculations of hull structures and special arrangements are to be made for verification of finally selected scantlings of the structures and arrangements, thickness of the moulded structures and panels with regard to the material used.

.5 Strength calculations to be submitted to the Register are to include:

.5.1 calculations of external loads for general and local hull strength;

.5.2 calculations of external loads for strength of special arrangements;

.5.3 general hull strength calculation;

.5.4 local hull strength calculation;

.5.5 strength calculation for special arrangements;

.5.6 reports on results of experimental studies of strength of assemblies and joints of the hull and special arrangements.

.6 Calculations of hull general and local strength as well as strength of special arrangements are to confirm that the greatest normal and tangential stresses as also the greatest stresses in air cylinders under the action of the design loads do not exceed the values given in 1.5.2, with the structure being intact and its shape remaining the same (except for air cylinders).

.7 Along with checking strength of the structures from the viewpoint of stresses, buckling stability of the whole structure and its individual components is to be checked where it is required by these standards or operational conditions of the structure.

Buckling stability of frames and stringers in relation to design stresses because of the total lateral bending is to be provided with at least double reserve.

.8 In general case the strength calculation is to contain:

.8.1 determination of values and nature of design loads;

.8.2 determination of the greatest normal and tangential stresses in the cross-sections of the structure depending on the stressed condition for assumed design loads;

.8.3 assignment of standards on hazardous stresses;

.8.4 determination of the margin of strength with regard to standards on permissible stresses.

1.3.2 Strength calculations.

Static strength calculations of WIG craft the hull structure of which is made of sandwich-construction panels are made for the critical condition.

Margin of strength is expressed in safety factors. The safety factor is assumed equal to 1,5.

When checking strength, design stresses are compared with breaking stresses.

Breaking stresses for tension and compression areas are distinguished.

Breaking normal stresses for sandwich-construction panels the load-bearing laminates of which are made of a carbon-filled plastic are assumed equal to:

in the tension area

$$\sigma_{br} = K_1 \sigma_s^{cm};$$

in the compression area

$$\sigma_{br} = K_2 \sigma_s^{cm},$$

where $K_1 = 0{,}88$; $K_2 = 0{,}5$;

σ_s^{cm} = ultimate strength of the composite material with mixed laying-up system in which laminates oriented at 0°, ±45° and 90° are used, is to be calculated from the following formula:

$$\sigma_s^{cm} = \sum_{i=1}^{n} \frac{n_i}{n} \sigma_i \cos^4 \alpha_i ,$$

where σ_i = ultimate strength of one-directional laminate with zero angle of orientation;

n = number of laminates;

n_i = number of laminates with i-th angle of orientation;

α_i = orientation angle of one-directional laminate.

Breaking normal stresses for sandwich-construction panels, the load-bearing laminates of which are made of glass-reinforced plastic, are assumed equal to those for laminates with 45° orientation:

in the tension area

$$\sigma_{br} = (\sigma_s^0 + \sigma_s^{90})/2,$$

where σ_s^0, σ_s^{90} = ultimate strength of a plastic single skin in tension along and across the warp;

in the compression area

$$\sigma_{br} = (\sigma_{-s}^0 + \sigma_{-s}^{90})/2,$$

where σ_{-s}^0, σ_{-s}^{90} = ultimate strength of a plastic single skin in compression along the warp and across the warp.

In the compression area total buckling of sandwich-construction panels is not allowed, i.e.:

$$\sigma_s < \sigma_{cr},$$

where σ_{cr} = critical stress in load-bearing laminates of a sandwich-construction panel.

Where critical stresses of the panel are less than the breaking stresses determined as a fraction of σ_s, then σ_{cr} of the panel is to be assumed as the adequate strength criterion in the compression area.

The design tangential stresses in sandwich-construction panels are compared with breaking stresses

$$\tau_{br} = \tau_s,$$

where τ_s = ultimate strength in case of shear of a single skin, provided no buckling of sandwich-construction panels occurs in case of shear, i.e. $\tau_{br} < \tau_{cr}$.

Breaking stresses in metal structures are taken equal to:

$$\sigma_{br} = K\sigma_s,$$

where $K = 0{,}9$ is a coefficient of concentration in the area of weld seams or riveted joints.

The general strength of structures of special arrangements is checked for the maximum design loads in sections weakened by openings.

The general strength of WIG craft hull structure is checked at least in three cross-sections for sagging and hogging.

In those structures of special arrangements where flexural and shear stiffness of cross-sections is constant along the length, strength is checked in one or two sections. Local strength of the structure components is checked for local loads, and the design stresses are compared with the breaking stresses. Strength of joint assemblies of separate structures of WIG craft special arrangements is to provide transition of forces from one structure to another. The design stresses obtained in the components of joint assemblies are to be compared wit breaking stresses.

1.3.3 An adequate operational reserve of the main (typical) assemblies and joints is to be provided for the hull and special arrangements.

The reserve of the structures other than typical ones may be determined, having regard to inspections and repairs carried out in service. The intervals between the inspections of such structures is to be agreed with the Register.

SECTION 2. GENERAL REQUIREMENTS FOR HULL STRUCTURE

2.1 General.

2.1.1 The requirements given below apply to hulls made of polymer composite materials.

2.1.2 Generally a combined framing system is used in structure. The longitudinal framing system is used for wings. The transverse framing system is used for hull and a plate for central air cylinder.

All deep members, frames, side girders and side stringers, bulkheads as well as reinforcements in the area affected by concentrated loads (foundation under the pylon, seatings for main engines) are to fitted directly on the shell plating.

2.1.3 The scantlings of hull structures are to be determined on the basis of calculations of general and local strength.

2.1.4 Any change in shape or section of hull members is to take place gradually. All openings are to have rounded corners and smooth edges.

2.1.5 The scantlings of sections and structural elements of the longitudinal members are to change throughout the length of the craft hull.

2.1.6 Continuity is to be ensured for as many of the main longitudinal members as possible. Gradual change of their sections is required in way of the ends of the longitudinals. Where the continuity of the members is broken, including the case of sharp change in their direction, provision is to be made for a proper bond of structures.

2.1.7 No more than two main deck, side and bottom longitudinals symmetrically located about the centre line are to be ended in one cross-section of the hull.

2.1.8 Unless stated otherwise in the Rules, a decrease in the depth of the main deck, side and bottom longitudinals is to be provided at a length not less than 1,5 times the member depth.

The longitudinal ends are to be brought to the nearest transverse member and to be attached thereto.

2.1.9 Rectangular openings in the deck, sides and longitudinal bulkheads are to be oriented with the larger side along the length of WIG craft. The rounding-off radius of the corners of the rectangular openings is to be not less than 0,15 of the smaller side of the opening.

2.1.10 The design of the wing, skegs and air cylinders which have contact with the water (land) surface in the transient modes is to be selected with the aim to ensure their operational ability during the whole service life.

2.2 Types of joints.

2.2.1 Jointing of framing members.

.1 Framing members are to be butt-joined. The distance between flange joints and web joints is to be taken equal to not less than half the member depth.

Lap joints are not allowed.

.2 The contact area of framing members is to be increased not less than 1,5 times in places of joining longitudinal and transverse members.

2.2.2 Riveted and glued riveted joints.

.1 These requirements apply to hull structures made of metal and polymer composite constructions, using riveting and glue riveting.

Riveted and glued riveted joints are recommended for connectors, hatch coamings and door sills.

.2 Cold rivets are to be used for riveting, utilizing non-hammering methods.

The design diameter of a rivet is the least diameter of the rod. The material for rivets is to be chosen depending on the grade of materials to be joined, of which the structures are made and is to comply with the requirements of Part XIII "Materials" of Rules for the Classification and Construction of Sea-Going Ships with due regard for corrosion conditions.

The types of rivets used and types of glues are to comply with the existing standards agreed with the Register.

.3 Glued and glued riveted joints may be lap joints or butt joints on the straps the thickness of which is to be not less than that of the parts to be joined.

.4 The diameter of the rivet for riveted joints of the parts made of polymer composite materials is to be chosen in accordance with Table 2.2.2.4.

The minimum width of overlapped sheets in riveted joints is to be:

6d (d = rivet diameter, mm) for one-row joints;

9d for double-row joints.

Table 2.2.2.4

Design thickness of item, mm	Rivet diameter, mm	
	recommended	permissible
1,0 — 2,5 3,0 — 5,0	2,0 3,0	2,6 — 3,0 2,6 — 4,0
Notes: 1. The lesser thickness of the items to be joined is to be taken as the design thickness. 2. For joints with the use of straps the thickness of the latter is neglected.		

.5 The parameters of riveted and glued riveted joints used in butts, seams and other structural assemblies are to be determined by calculations depending on the purpose of the joint. The glue layer is neglected in the calculations, i.e. the parameters of riveted and glued riveted joints are to be determined in the same way as for riveted joints.

.6 Recommended parameters of a riveted joint are shown in Table 2.2.2.6.

Table 2.2.2.6

Type of joint	Rivet pitch, mm	Distance between rows, mm	Minimum number of rows	Rivet arrangement
Strength joint	$(6,0 \div 7,0)d$	$(2,0 \div 5,0)d$	1 for framing members 2 for joints and seams	Staggered and chain
Strength and tight joint	$(3,5 \div 5,5)d$	$2,0d$	$2 \div 3$ for joints and framing members	Staggered
Tight joint	$(3,5 \div 4,0)d$	$2,0d$	2 for joints and framing members	Staggered
d = rivet diameter, mm. A strength joint is a joint on which strength requirements without provision of tightness are imposed. A tight joint is a joint on which tightness requirements are imposed. A strength and tight joint is a strengthened impenetrable joint.				

.7 The length of a rivet rod of 4 mm in diameter made of aluminium alloys is chosen in accordance with Table 2.2.2.7.

Table 2.2.2.7

Type of point	Counter-sunk head	Rounded counter-sunk head	Flat head	Round head
Rod length, mm	$s + 0,9d$	$s + 1,1d$	$s + 1,2d$	$s + 1,3d$
s = total thickness of the items to be joined, including the thickness of the gasket, if fitted, mm; d = rivet diameter, mm.				

.8 It is recommended that holes for rivets be made by drilling.

The diameter of the rivet holes is to be greater than the rivet diameter by 0,1 mm.

.9 All defective rivets (weak with eccentric or fractured heads; with heads coming off the laminate surface or section flange; with improperly riveted or small-sized heads, etc) are to be replaced.

2.2.3 Joints.

.1 The items of joints assemblies are to be readily accessible for inspection. The joints are to be so designed that the risk of delamination of multi-laminate materials is prevented. The joints assemblies are to be experimentally checked, if necessary.

.2 Rivets, bolts and washers are to be made of corrosion-resistant materials or are to be coated with anti-corrosive coating.

.3 The diameter of the bolt holes is to correspond to the bolt diameter. The distance between the hole centre and the edge of the multi-laminate material is to be not less than three times the diameter of rivets and bolts.

.4 In stressed joints, washers with an outside diameter equal to at least two diameters of the hole and a thickness equal to 0,1 of the hole diameter but not less than 0,5 mm are to be placed under the bolt head and nut. Where the size of the bolt head meet the requirements for washers, the latter may be omitted. It is recommended that bigger washers be placed in particularly stressed joints.

.5 Watertight joints are to be sealed before rivets or bolts are fitted.

.6 Threaded joints may be used in low-stressed joints. The decision on the use of threaded fasteners is taken depending on test results in each particular case. Threaded fasteners are to be fitted as far as possible perpendicular to the multi-laminate material. The material which keeps threaded fasteners is to have a thickness at least 5 mm or a reinforcing sheet is to be fitted in the multi-laminate material.

2.3 Hull (openings).

2.3.1 Windows, doors.

.1 The upper and lower edges of window openings are to be strengthened by reinforced longitudinal members fitted at a distance at least 5s from the opening edges where s = thickness of side shell plating of the superstructure (strong deckhouse), mm. Additional strengthening is to be provided in the corners of the openings. Doors in bulkheads are to have a sill at least 300 mm high and additional strengthening.

.2 Hatch openings in the deck and wings are to have the same strength as the deck and wings. Closing and battening-down appliances for hatchways are subject to special consideration by the Register in each particular case.

.3 Windows are to have the same strength as the strength hull and to be weathertight.

2.3.2 Hull strengthening in way of vertical tails and pylon.

.1 At least one longitudinal and one transverse member are to be fitted under each vertical tail. In separate cases, additional primary members may be fitted. Brackets with flanges are to be fitted between primary and additional members.

.2 Openings for inspection and painting of concealed places may be made in strengthening members provided the places are reinforced.

2.4 Damping devices (air cylinders).

2.4.1 General.

.1 The requirements given below cover the air cylinders of air damping devices made of rubber fabric and polyurethane materials ($s < 6$ mm) with the use of glued, glued and sewn, bolted and other joints.

.2 The type of the air cylinder and its structural arrangement are to be chosen at early design stages, based on the conditions of provision of seaworthy, amphibious and other operating qualities of the designed WIG craft.

.3 The scantlings, constructions and type of main joints and assemblies of air cylinders are to be chosen regarding the available experience of design and operation of similar craft and based on the analysis of laboratory strength test results of prototypes made according to the technique and under the conditions of the manufacturer. The list of assemblies subject to laboratory testing and types of the required tests are to be agreed with the Register.

.4 Where no prototype is available, the dimensions of air cylinder joints and assemblies are to be assigned on the basis of conditions of provision of their strength equal to that of the main material in static tension.

.5 The laboratory test results of air cylinder joints and assemblies are to be submitted to the Register.

.6 Where positive operational experience for a close prototype is available, laboratory tests of air cylinder joints and assemblies may be omitted. Decision on omitting or reducing the scope of laboratory tests is to be agreed with the Register.

.7 For air cylinder designs distinct by quite new technical solutions, constructional materials or anticipated service conditions, an experimental skirt is to be manufactured aiming at subsequent improvement of the design based on operational results. The decision on the necessity of experimental operation is to be agreed with the Register.

.8 An experimental air cylinder set is to be tested under service conditions within the limits of the intended service life in accordance with the programme approved by the equipment. In justified cases, it is advisable that two or more experimental air cylinders sets or experimental sections be made to choose the best design.

.9 The results of periodical inspections of air cylinders in experimental service are to be recorded in the appropriate reports containing recommendations on maintenance and further improvements of the design. The intervals between inspections are to be agreed with the Register. The report on test results of the experimental air cylinder set containing the data on actual service life and other operating characteristics of the construction developed is to be submitted to the Register.

2.4.2 Main types of assemblies and joints.

.1 Main structural assemblies of the air cylinder are:

mounting joint assembly (connection of sections);

panel joint assembly (joints);

other assemblies (attachment of guy rope, diaphragm and coaming to the panel, panel with openings, detachable element attachment).

.2 Structural design of air cylinder assemblies is chosen to provide serviceability of the air cylinder during the intended service life in accordance with the requirements of 2.4.3.1 and 2.4.3.2.

2.4.3 Air cylinder construction.

.1 The construction of the air cylinder is to provide its efficient operation in all service conditions under the effect of all operational factors identified in the technical assignment for design.

.2 In order to ensure serviceability and maintainability of the air cylinder within its specified service life, provision is to be made in its construction for the possibility of replacement of the components subject to quick wear.

.3 The attachment assemblies are to cause no failures of the adjacent components of the air cylinder. Metal elements of the attachments are to be made of corrosion-resistant materials or to have an anti-corrosive coating.

.4 All the materials used in the construction of the air cylinder are to correspond to the service conditions and loads specified in the technical assignment and to provide the minimum weight of the appliance possible.

.5 The construction of the air cylinder is to be simple, technologically effective, easy in operation, readily accessible for maintenance, mounting, dismantling; it is to provide the possibility of replacement of worn-out components and performance of repairs on WIG craft without much dismantling work.

In justified cases, field joints are to be provided in the construction of the air cylinder to make manufacture, installation, dismantling and repair of the air cylinder easier. Sections are to be unified as far as possible.

.6 The list of the technical requirements for the construction of the air cylinder is to be provided by

the technical assignment for its design and to be compiled with regard to its structural features and anticipated service conditions.

2.5 Seatings.

.1 Seatings for craft's machinery (engines, reduction boxes, blowers, etc) are to have sufficiently strong and rigid construction. The requirements for rigidity of seatings for craft's machinery and floors on which they are to be installed are to comply with the requirements of the specifications for installation of the appropriate machinery.

.2 The configuration and construction of seatings are to be dependent on the construction of the machinery, areas of their location and loads acting on the seating.

.3 The longitudinal girders of the seatings for the main machinery are to coincide with side girders or provision is to be made for additional members that provide gradual transition of forces from the seatings to the hull.

.4 The ends of the seatings longitudinals are to be attached to transverse bulkheads or to floors of increased section modulus and terminate with brackets located in the plane of longitudinals and brought to transverse members (floors, web frames).

.5 Horizontal plates of seating girders in the area of fastening bolts are to be stiffened by vertical brackets equally spaced in relation to bolt openings. The vertical dimension of the brackets is to be twice as much as their horizontal dimension.

.6 The longitudinal girders of seatings are to be stiffened on each floor with transverse brackets interconnecting longitudinals, and knees fitted outside the longitudinals, counting from the axial line of the machine shaft. The width of brackets is to be not less than their depth, and the thickness is to be by 20% greater than that of the floor webs. Where the length is more than 45 thicknesses, free edges of brackets and knees are to have a face plate or a flange. The ends of the face plates and flanges are to be sniped.

.7 Lightening holes are permitted in the webs of the seating longitudinals. The openings are to be reinforced.

.8 Seatings of small auxiliary machinery may be made as brackets attached to the framing members of WIG craft structures. Seatings are to be placed on the least stressed parts of the framing members in such a way that the supporting plate is fitted in the plane of the face plate of the framing members.

PART III. ARRANGEMENTS, EQUIPMENT AND OUTFIT

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 This Part of the Rules covers arrangements, equipment and outfit necessary to provide normal operation of WIG craft under all conditions specified in the Classification Certificate.

1.1.2 Arrangements, equipment and outfit not considered in this Part of the Rules and intended for special purposes are subject to supervision by the Register as far as reasonable and practicable.

1.2 Definitions and explanations.

1.2.1 For the purpose of this Part of the Rules the definitions and explanations given in Section 2,"General" of the Rules and in Part III "Arrangements, Equipment and Outfit" of Rules for the Classification and Construction of Sea-Going Ships have been accepted.

SECTION 2. RUDDER AND STEERING GEAR

2.1 General.

2.1.1 Every WIG craft is to have a reliable device capable to ensure its steering and course-keeping facilities in all operational modes. Air or water rudders, stabilizers, flaps, nozzle rudders or nozzles may be used as such devices. Course control may be effected by changing the propeller thrust or the geometrical form of WIG craft or by combination of both.

2.2 Initial design loads.

2.2.1 The maximum values of aerodynamic and/or hydrodynamic forces and torque likely to occur in the range of assumed rudder angles for the appropriate rudder are to be taken as the design loads. Materials that confirm that the values adopted are in fact the maximum values are to be submitted to the Register. The torque on the stock of the rudder when a buffer is fitted in gear is to be taken depending on the buffer characteristics.

2.2.2 Design loads are to be determined by a calculation method or to be based on the model tests. The calculations or the materials of the model tests are to be submitted to the Register together with the documentation on steering gear.

2.2.3 Initial loads are to be determined for the maximum speed of WIG craft in two modes: in the displacement mode and in the ground effect mode.

2.3 Calculations of steering gear main components.

2.3.1 Aerodynamic and/or hydrodynamic loads (force, torque) acting on the appropriate rudder are to be taken into account in the calculations with an accuracy acceptable for the Register.

2.3.2 Bending moments, shear forces and support reactions acting on the steering gear components, having regard to the type of the steering gear used, its main dimensions, pliability of supports, etc are to be determined in strength calculations with an accuracy acceptable for the Register.

2.3.3 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 are not to exceed 0,5 times the upper yield stress. The specific pressure on the supports is not to be more than that given in Table 2.3.3.

Table 2.3.3

Material of the pair in friction	Specific pressure p, MPa	
	in backwash	outside backwash
Stainless steel — bronze	—	15,0
Stainless steel — rubber	6,0	8,0
Stainless steel — caprolon	—	6,0

2.3.4 The dimensions of the main components of the rudder and steering gear of WIG craft in the displacement mode are to meet the requirements of Part III "Arrangements, Equipment and Outfit" of Rules for the Classification and Construction of Sea-Going Ships as far as reasonable and practicable.

2.4 Steering gear.

2.4.1 Methods of 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-mentioned performances are verified by the Register only during sea trials of WIG craft for compliance with the requirements of 2.4.2 to 2.4.5.

2.4.2 Steering gear, their controls and actuating systems are to comply with the requirements of Parts IX, XI and XV of the Rules.

2.4.3 There must 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, the steering gear allows to shift each rudder independently of other rudders and

adequate steerability of the craft is ensured with one rudder.

2.4.4 The steering gear of the air rudder is to be capable in the ground effect mode of putting the rudder over from 10° from one side to 10° on the other side in not more than 15 s, with the craft running at the maximum speed.

2.4.5 The steering gear of the water rudder in the displacement mode is to be capable of putting the rudder over from 30° from one side to 30° on the other side in not more than 15 s, with the craft running at a speed of 7 knots.

2.4.6 The steering gear may be hand-operated provided it is handled by one man with a force at the handwheel of not more than 120 N. A short-time increase of the force up to 200 N is allowed.

2.4.7 The rudder arrangement is to be provided with a system of rudder stops permitting to put the rudder over on either side to an angle of not more than 15° for the air rudder in the ground effect mode and of not more than 35° for the water rudder in the displacement mode. The greater angle of shifting the rudder in both modes is subject to special consideration by the Register in each case.

SECTION 3. ANCHOR ARRANGEMENT

3.1 General.

3.1.1 Each WIG craft is to 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, WIG craft is to be provided with a device for securing the anchor wire rope (chain cable) for riding the craft at anchor.

3.2 Calculation of anchor arrangement.

3.2.1 The mass of each bower anchor, kg, is to be not less than:

$$Q = 1{,}75N_e\ , \tag{3.2.1}$$

where N_e = equipment number according to 3.2, Part III "Arrangements, Equipment and Outfit" of Rules for the Classification and Construction of Sea-Going Ships.

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 using Formula (3.2.1).

3.2.2 The length l, m, of the anchor wire rope (chain cable) for the bower anchor is not to be less than:

$$l = 7{,}5\sqrt{Q} + 20, \tag{3.2.2}$$

where Q = anchor mass, kg.

3.2.3 The breaking strength F_{st}, kN, of the anchor wire rope (chain cable) is to be not less than:

$$F_{st} = 0{,}06kQ\ , \tag{3.2.3}$$

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;
Q = anchor mass, kg.

3.2.4 Ends of a wire rope are to be spliced into sockets, clamps or thimbles. The wire rope is to be connected with the anchor shackle by means of the joining shackle.

3.2.5 WIG craft not fitted with anchor machinery may be provided with synthetic fibre ropes in lieu of wire ropes (chain cables). The breaking strength F_{syn}, kN, of the synthetic fibre rope is to be not less than:

$$F_{syn} = 0{,}124\delta_{av}F_{st}^{\,8/9}, \tag{3.2.5}$$

where σ_{av} = average relative elongation in breaking a synthetic fibre rope, %, but not less than 30%.
F_{st} = breaking strength of the wire rope as a whole determined from Formula (3.2.3), kN.

3.2.6 The end of the synthetic fibre rope is to be spliced into a thimble and to be secured to the anchor, as far as possible, by a wire rope (chain cable) section at least 10 m long which complies with the requirements of 3.2.3 and 3.2.4.

The length of the wire rope (chain cable) section may be included in the required length of the rope determined from Formula (3.2.2).

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

SECTION 4. MOORING AND TOWING ARRANGEMENTS

4.1 General.

4.1.1 Each WIG craft is to be supplied with mooring arrangement for warping to a coastal or floating berth.

4.1.2 WIG craft is to be provided with towing arrangement capable to ensure safe towing. Other arrangements on board the craft may be used for towing purposes. The safe towing speed is to be determined during delivery trials of the first craft of a series.

4.1.3 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.

4.1.4 Mooring and towing arrangements are to be designed and secured so that watertight integrity of WIG craft is not impaired in case of their damage.

4.2 Calculation of mooring arrangement.

4.2.1 The number of mooring ropes n on WIG craft is to be not less than:

$$n = 1{,}5 + 0{,}004N_e, \quad (4.2.1)$$

where N_e = equipment number according to 3.2, Part III "Arrangements, Equipment and Outfit" of Rules for the Classification and Construction of Sea-Going Ships.

The results of calculations using Formula (4.2.1) are to be rounded off to both sides to the nearest figure. In all cases, the number of mooring ropes is not to be less than two.

4.2.2 The length of each mooring rope l, m, is to be not less than 1,5 times the length of the craft with rounding off to the nearest 5 m. With $Ne \geqslant 500$ the length of a mooring rope may be taken equal to $1{,}2L$ (where L is the length of WIG craft, m).

4.2.3 The breaking strength F_{st}, kN, of the wire rope as a whole is to be not less than:

$$F_{st} = 5{,}0\sqrt{N_e}\,. \quad (4.2.3)$$

4.2.4 Mooring ropes may be of steel wire, natural fibre or synthetic fibre material. The breaking strength Fsyn , kN, of the synthetic fibre rope is to be not less than:

$$F_{syn} = 0{,}074\delta_{av}F_{st}, \quad (4.2.4)$$

where σ_{av} = average relative elongation in breaking a synthetic fibre rope, %, but not less than 30%;
F_{st} = breaking strength of the wire rope as a whole determined from Formula (4.2.3), kN.

Irrespective of the breaking strength regulated by Formulas (4.2.3) and (4.2.4), mooring ropes made of natural fibre or synthetic fibre material less than 20 mm in diameter are not to be used. On agreement with the Register the use of ropes of smaller diameter for WIG craft with equipment number $N_e \leqslant 50$ is allowed.

SECTION 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. Hull structure components, wings, stabilizers, skegs, etc are used for such purpose in WIG craft to the maximum degree possible.

5.2 Arrangement, height and equipment installed on the signal masts are to comply with the requirements of 3.2 of Rules for Dynamically Supported Ships as far as it is reasonable and practicable.

SECTION 6. ARRANGEMENT AND EQUIPMENT OF SHIP'S SPACES

6.1 WIG craft are to have an enclosed passenger compartment provided with seats for a navigator and passengers. The width of passage between the seats is to be not less than 0,33 m.

6.2 All seats are to have a high back, soft upholstering, supports for arms and be provided with safety belts of adequate strength to take up the loads likely to arise under emergency situations.

6.3 Provision is to be made for changing the position of the navigator's seat lengthwise to make it comfortable.

6.4 A view with a field of vision 270° in the horizontal plane, and at least 7° upwards and 14° downwards in the vertical plane is to be provided from the navigator's seat.

6.5 Embarkation to WIG craft is to be provided from either side through side doors with a doorway width not less than 0,7 m.

SECTION 7. EMERGENCY OUTFIT

7.1 Emergency outfit depends on the type of WIG craft and is subject to special consideration by the Register in each case.

PART IV. STABILITY

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 This Part of the Rules applyes to WIG craft referred to in 1.1, "General" of the Rules.

1.1.2 The requirements of this Part do not extend to light-craft condition.

1.2 Definitions and explanations.

1.2.1 Definitions and explanations relating to general terminology are given in Section 1, "General" of the Rules and in Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships.

1.2.2 WIG craft intended for carriage of passengers, whatever their number may be, are to be considered for the purpose of this Part as passenger craft.

SECTION 2. GENERAL TECHNICAL REQUIREMENTS

2.1 Stability of WIG craft is to be verified for all modes: displacement, transitional, skimmimg, take-off/landing and ground effect modes, and amphibian mode also for amphibian craft.

2.1.1 Stability may be verified by calculation and experimental methods. The verification procedures are to be approved by the Register.

2.1.2 Stability characteristics of designed WIG craft in the displacement mode are to be determined by calculation; in other modes, experimentally by testing a model of designed WIG craft or on the basis of the materials of full-scale trials of the WIG craft prototype.

2.1.3 Stability characteristics of built WIG craft are to be finally corrected in the displacement mode in accordance with the results of the inclining test (see Section 3), in other modes according to the experimental data obtained during delivery trials of WIG craft prototype.

2.2 WIG craft stability is to be verified for the following loading condions:

2.2.1 with full number of passengers and cargo, and full provisions;

2.2.2 without passengers and cargo and with 10% of provisions.

The mass of passengers and their centre of gravity position are to be taken in accordance with 3.1.8, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships.

2.3 The stability of WIG craft in all modes is to be additionally verified in calm water under the loading condition with full number of passengers and cargo, and with 10% of provisions but with 50% of the passengers sitting in their seats on one side from the craft centre line. The rest 50% of the passengers are located in longitudinal passages between the chairs in compliance with 3.1.6 to 3.1.9, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships.

2.4 If in the process of WIG craft normal operation the worse loading conditions with regard to stability are intended in comparison with those which were mentioned in 2.2 and 2.3, then the stability for those conditions is to be verified as well.

2.5 The requirements of 1.4.2.1, 1.4.2.3, 1.4.5, 1.4.6, 1.4.8 to 1.4.11, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft in the displacement mode. Calculations of the arms of form stability for WIG craft in compliance with 1.4.2.1, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships are to be carried out with respect of accompanying trim.

2.6 Stability according to weather criterion is not verified. Operation of WIG craft, however, is to be allowed with restrictions on the distance from the shore and place of refuge, wind and sea conditions.

2.7 In the areas of particular wind and sea modes additional restrictions may be introduced. These areas of particular wind and sea modes are:

surf (breakers) wave zones;

zones of local increase of the wave height and its sternness (bars in the river mouths, the so called waves "crush" and so on);

zones of local increment of wind speed, direction and gust (in the narrow places, near precipices, rocks, islands, because of formation of whirls behind the coast or floating objects and so on).

Zones of specific wind and sea modes are specified according to data of local hydrometeorological and hydrographical institutions.

2.8 Stability Information for WIG craft is to contain data connected with providing its stability in all modes as well as all restrictions set up for it: range and the navigation seasons, wind force and wave height, angles of safe putting over the rudder, etc. In compiling the Stability Information, one must be guided by Appendix 1 to Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships, having regard to WIG craft specifics and requirements of the Rules.

SECTION 3. INCLINING TEST

3.1 The requirements of 1.5, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships, apply to WIG craft as far as reasonable and practicable.

3.2 On agreement with the Register, other methods of determining light-craft displacement and centre of gravity of WIG craft are allowed.

SECTION 4. DEPARTURES FROM THE RULES

4.1 The requirements of 1.6.1 and 1.6.2, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships, cover WIG craft as far as reasonable and practicable.

SECTION 5. CONDITIONS OF SUFFICIENT STABILITY

In the worst loading condition in respect of stability out of those referred to in 2.2 to 2.4, stability is considered sufficient, provided that:

5.1 the numerical values of parameters of the static stability curve in the displacement mode are not to be lower than those stated in 7.1 and 7.2;

5.2 it is demonstrated that under weather conditions, including the worst intended, WIG craft when in the skimming and ground effect modes of operation do not lose the modes;

5.3 when in the transitional and take off/landing modes of operation WIG craft meet the requirements of 8.6;

5.4 influence on the stability of the icing possible consequences is taken into account according to 7.3;

5.5 requirements of Section 8 for stability in service are met.

SECTION 6. PASSAGE OF WIG CRAFT FROM ONE PORT TO ANOTHER

6.1 The requirements of 1.8, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft.

SECTION 7. GENERAL REQUIREMENTS FOR STABILITY

7.1 Static stability curve.

7.1.1 The requirements of 2.2, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships, apply to WIG craft in the displacement mode as far as reasonable and practicable.

7.1.2 WIG craft that do not comply in the displacement mode with the requirements of 2.2.1 and 2.2.2, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships, regarding the position and maximum of the static stability curve are allowed to navigate, provided the angle of the maximum of the static stability curve (or angle of flooding) is not less than 10° and the maximum arm of the curve is not less than 1,0 m.

It is, however, necessary that the assumed angle of vanishing stability determined on the assumption of watertight closing of openings through which flooding occurs is not less than that required in 2.2.1 and 2.2.2, Part IV "Stability" of Rules for the Classification and Construction of Sea-Going Ships.

7.2 Metacentric height.

7.2.1 The corrected initial metacentric height under all loading conditions and in all operational modes is to be positive.

7.3 Allowance for icing.

7.3.1 The possibility of WIG craft operation under conditions of likely icing and design rate of icing is subject to special consideration by the Register in each particular case.

SECTION 8. STABILITY IN SERVICE

8.1 Stability of WIG craft in the displacement mode in calm water is to be such that deviation of WIG craft from the horizontal plane in any direction under all allowable loading conditions and likely uncontrollable movements of passengers does not exceed the angle at which only 0,1 m or 8°, whichever is the less, remains before the deck (the upper surface of the load-bearing wing without flaps) enters the water.

8.2 In the displacement mode in calm water the angle of heel because of the combined effect of heeling moments resulting from crowding of passengers in accordance with 2.3 and turning is not to exceed the angle of wing entrance into the water. The angle of heel because of the combined effect of turning and crowding of passengers is to be determined experimentally.

8.3 In the displacement mode under critical design conditions and the worst loading condition (with regard to stability) the angles of heel or trim are not to exceed the value of 0,8 of the angle of heel or trim which corresponds to the entrance of the air wing (without flaps) into the water or 12°, whichever is the less.

8.4 In calm water on the straight course the angles of heel because of crowding of passengers according to 2.3 are not to exceed the value of 0,8 of the angle of heel in the transitional mode, and the value 0,5 of the angle of heel in the take-off/landing mode which corresponds to the entrance of the air wing into the water or 12°, whichever is the less.

8.5 It is to be proved by calculations or by trials that in the transitional, skimming, take-off/landing and ground effect modes (and amphibian mode also for amphibian WIG craft) within the proved operation restrictions, a craft will go back to the initial position being provoked to rolling, pitching and heave motions or a heel because of turning or any their combination without occurrence of hazardous motions, heel, trim or course change.

8.6 WIG craft is to stay in the transitional and take-off/landing modes in the worst permissible weather conditions and the worst loading variant (in respect of stability) for the minimal time, if it will not be proved to the Register that change of the stability is not risky. Hereby, the angles of heel are not to exceed the value of 0,8 of the angle of heel in the transitional mode, and the value 0,5 of the angle of heel in the take-off/landing mode which corresponds to the entrance of the air wing into the water or 12°, whichever is the less.

8.7 It is to be proved that in the transitional, skimming, take-off/landing and ground effect modes no hazardous situations will arise on surface-piercing structures or appendages subsequent to a collision with a floating or a submerged object which might result in dangerous vertical motions, heel, trim or change in the course of WIG craft.

8.8 It is to be shown that in case of any fault of WIG craft that can adversely affect stability in all operational modes provision is made for safe transition of WIG craft into the displacement mode and, in case of movement over the ground, for the safe landing and stopping.

8.9 While in the skimming and ground effect modes of operation when turning in calm water the angle of heel is not to exceed:

0,5 of the angle of wing entrance into water when in the skimming mode;

the angle of entrance of the skeg into the water when in the ground effect mode in calm water at the design altitude;

or 8°, whichever is the less.

8.10 In the ground effect mode with a heeling load because of wind pressure or turning (whichever is the greater) and directed to the side of heel caused by crowding of passengers according to 2.3, the angle of heel is not to exceed the angle of skeg entrance into the water or 12°, whichever is the less. The total angle of heel because of crowding of passengers and wind pressure or crowding of passengers and turning is to be determined on the basis of the calculation and model tests of designed WIG craft or WIG craft prototype. The total angle of heel because of crowding of passengers and turning is to be determined more accurately during the delivery trials.

8.11 In the ground effect mode the stability by all course angles of wind and waves is to be confirmed by full scale trials. Under the worst allowable conditions and the worst loading condition (with regard to stability) by the direct course as well as by turning from the following course to the head wind and waves, the maximum angle of heel is not to exceed the angle of skeg entrance into the water or 12°, whichever is the less. The angle of the skeg entrance is determined from the still water surface for the design attitude of flight in waves.

8.12 If WIG craft is specially designed so that for the purpose of reduction of the turning radius, when in the ground effect mode, it is supposed to use a contact of the skeg edge of the wing with water surface, then the safety of such manoeuvre is to be proved and the appropriate restrictions are to be set up on altitude, speed, depth of skeg submergence, angle of heel, angle of trim, yaw of craft, wave characteristics and so on. Execution of these provisions does not abolish the need to check the satisfaction of the requirements which are prescribed by the Rules on execution of circulation without touching the sea by skeg.

8.13 If the system for changing the gas jets directions of the air engines is used on WIG craft in order that these jets be directed under the air wing, then the effect of such system on craft stabilization is to be taken into account.

8.14 Experimental examination of the transverse stability of the full-scale craft in calm water on the direct course is carried out in the following way: by displacement of the solid ballast (not less than two heeling moment values); corresponding angles of hell and trim are measured for the displacement, transitional, skimming, take-off/landing and ground effect modes of operation. The maximum heeling angle is not to be less than the moment corresponding to the loading condition referred to in 2.3.

8.15 Conditions of the experimental examination of the longitudinal stability is subject to special consideration by the Register in each case.

8.16 For WIG craft designed to go out on the protected or not protected from waves gently sloping shore, the sufficient stability is to be shown to the Register when in such manoeuvre as well as when overcoming the wave breaking zone under the worst allowable or other conditions which are indicated in the documentation. These evidences are to be confirmed during the delivery trials of the first

WIG craft of a series or any one WIG craft of the series which is indicated by the Register.

8.17 The methods of verification in accordance with 8.1 to 8.16 and the restrictions set up are to be agreed with the Register.

8.18 The heeling moments because of wind pressure are calculated as follows:

.1 The heeling moment M_v, kNm, for WIG craft in the displacement mode is taken as a product of the wind pressure P_v by the windage area A_v above the actual waterline by the vertical distance Z to the centre of windage from the centre of the projected lateral area of the portion of the craft below the plane of the acting waterline and by the streamline factor $f < 1$, which is determined by model tests in a wind tunnel ($f = 1$ if such data are lacking):

$$M_v = 0{,}001 P_v A_v Z f.$$

The value of P_v is determined according to Table 8.18 of the Rules at the wind force corresponding to the critical weather conditions. This wind force is to be at least one number higher than that which corresponds to the worst permissible conditions.

.2 The heeling moment M'_v, kNm, for WIG craft in the skimming mode is taken as a product of the wind pressure P'_v by the windage area A'_v above the actual waterline in this mode by the vertical distance Z' to the centre of windage from the centre of the projected lateral area of the portion of the craft below the plane of the acting waterline in this mode and by the streamline factor f' and the influence factor φ' of the aerodynamic loading:

$$M'_v = 0{,}001 P'_v A'_v Z' f' \varphi' .$$

The value of P'_v is determined according to Table 8.18 of the Rules at the wind force corresponding to the worst permissible conditions.

.3 The heeling moment M''_v, kNm, for WIG craft in the ground effect mode is taken as a product of the wind pressure P''_v by the windage area A''_v equal to the windage area of the whole craft in this mode by the vertical distance Z'' between the centre of windage area and the craft centre of gravity, by the streamline factor f'' and the influence factor of the aerodynamic loading:

$$M''_v = 0{,}001 P''_v A''_v Z'' f'' \varphi''.$$

The value of P''_v is determined according to Table 8.18 of the Rules at the wind force corresponding to the worst permissible conditions.

.4 The streamline factors f' and f'' are to be determined likewise to f according to 8.18.1 but for a trim which corresponds to the skimming and ground effect modes.

.5 The influence factors of the aerodynamic loading φ' and φ'' are determined respectively, using the following formulae:

$$\varphi' = w' + 0{,}9 \qquad \text{by } 0{,}6 < w' < 1{,}4;$$

$$\varphi'' = w'' + 0{,}9 \qquad \text{by } 0{,}6 < w'' < 1{,}4,$$

where $w' = 0{,}13 V'/\sqrt{P'_v}$ and $w'' = 0{,}13 V''/\sqrt{P''_v}$ are the relative wind speeds in the skimming and ground effect modes, respectively;

V' and V'' are speed of WIG craft in the skimming mode and the operational speed of WIG craft in the ground effect mode, knots.

Table 8.18

Wind pressure P_v, Pascal

Wind force		Vertical distance between the centre of windage area and the sea surface, m						
Beaufort Scale	m/s	1	2	3	4	5	6	7
2	5	15	20	25	25	30	30	35
3	7	50	60	65	70	75	80	85
4	9	95	120	135	145	150	160	165
5	12	155	195	220	235	250	265	275
6	15	240	300	335	360	385	400	415
7	19	435	545	605	655	700	730	750
8	23	705	875	970	1050	1115	1170	1230

PART V. RESERVE OF BUOYANCY AND SUBDIVISION

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 This Part of the Rules applies to WIG craft referred to in 1.1, "General" of the Rules, in the displacement mode.

1.1.2 It is recommended that all measures permitted by the purpose and operational conditions be taken on WIG craft not covered by the Rules to ensure the best characteristics possible of the reserve of buoyancy and subdivision.

The customer is to decide whether the fulfilment of the requirements of Sections 3 and 4 is mandatory and to what extent they are to be applied.

1.2 Definitions and explanations.

1.2.1 Definitions and explanations given in Section 2, "General" of the Rules and Part V "Subdivision" of Rules for the Classification and Construction of Sea-Going Ships, in 2.5 "Reserve of Buoyancy and Subdivision" of Rules for Dynamically Supported Ships and in Part IV "Stability, Subdivision, Freeboard" of Technical Requirements for Small-Sized Ships are to be applied to WIG craft as far as practicable.

WIG craft intended for carriage of passengers, whatever their number may be, are to be considered for the purpose of this Part as passenger craft.

1.2.2 For the purpose of this Part of the Rules the following definitions apply:

.1 Addition albuoyancy element is a watertight compartment, structure, double skin, etc or their elements filled with foam plastic and providing additional buoyancy of WIG craft in case of flooding.

.2 WIG craft flooded with water is a craft which cannot be more filled with water without its pouring out through the lowest freeboard point or opening.

1.3 Scope of supervision.

1.3.1 The scope of supervision is to comply with 1.3.1 and 1.3.2, Part V "Subdivision" of Rules for the Classification and Construction of Sea-Going Ships as far as they are applicable to WIG craft, having regard to the requirements of the Rules.

1.4 General technical requirements.

1.4.1 The assumed subdivision loadline is not to be higher than the waterline corresponding to the maximum draught, the use of which may be permitted for the particular WIG craft in accordance with Sections 2 and 3 of this Part of the Rules.

1.4.2 General technical requirements given in 1.4.1 to 1.4.6, Part V "Subdivision" of Rules for the Classification and Construction of Sea-Going Ships, apply to WIG craft as far as reasonable and practicable.

SECTION 2. INTACT BUOYANCY

2.1 WIG craft is to have a design reserve of buoyancy not less than 100% at the maximum displacement.

2.2 The reserve of buoyancy is to be calculated by including only those compartments which are:

.1 watertight;

.2 accepted by the Register as having scantlings and arrangements adequate to maintain their watertight integrity;

.3 situated in locations below the datum, which may be a watertight deck or equivalent structure capable to provide watertight integrity in the longitudinal and lateral directions;

.4 refer to additional buoyancy elements according to 1.2.2.

2.3 Arrangements are to be provided for checking the watertight integrity of buoyancy compartments.

SECTION 3. FREEBOARD

3.1 The freeboard for WIG craft in the displacement mode is to be assigned so that the requirements of the Rules regarding buoyancy, intact stability , and the requirements for emergency trim and stability for passenger craft are met.

3.2 The requirements of Load Line Rules apply to WIG craft as far as reasonable and practicable.

3.3 The value of freeboard depends on the height above the loadline of the watertight deck or an equivalent structure bounding the volumes included in the reserve of buoyancy.

3.4 The loadline, where possible, is to be painted on WIG craft sides or structures. The upper edge of the line is to correspond to the maximum draught.

SECTION 4. REQUIREMENTS FOR DAMAGE BUOYANCY AND STABILITY

4.1 General.

4.1.1 The trim and stability of WIG craft (with no allowance for icing) are to be sufficient to meet the

requirements for damage trim and stability of WIG craft.

4.1.2 The requirements for structure and subdivision of WIG craft are considered satisfied, provided with damages referred to in 4.3, in case of flooding of the compartments damaged under the worst possible position of the damage and permeabilities determined in accordance with 4.2, stability and trim of WIG craft meet the requirements of 4.4.

4.1.3 Calculations confirming compliance with the requirements of 4.4 are to be carried for such number of the worst (with regard to trim and stability) loading conditions, such location and size of damages referred to in 4.3 that one must be sure that in all other cases the condition of damaged WIG craft as regards trim and stability will be better.

The additional buoyancy elements, actual shape of the damaged compartment, their permeability, type of closing appliances, existence of intermediate decks, platforms, bulkheads and enclosures, watertight integrity of which is such that these structures are capable to limit completely or temporarily propagation of water in WIG craft are to be taken into account.

4.1.4 For passenger WIG craft damaged trim and stability are to be checked having regard to uncontrolled passenger movement which may occur in emergency situation as also having regard to likely damage of additional buoyancy elements.

4.2 Permeability.

4.2.1 Permeability of every space or compartment are to be taken into consideration in damaged stability and trim calculations in accordance with Part V "Subdivision" of Rules for the Classification and Construction of Sea-Going Ships or are to be determined by a calculation approved by the Register. The amount of water penetrated and elements of free surfaces are to be determined in the compartments of composite WIG craft up to the inner edges.

4.3 Extent of damage.

4.3.1 The following side damages having a shape of a parallelepiped are to be assumed in damage stability and trim calculations anywhere on the periphery of WIG craft:

the longitudinal extent of damage is to be 10% of length L;

the transverse extent of penetration is to be $0{,}2B$;

the vertical extent of damage is to be taken for the full depth of the craft.

4.3.2 Bottom damages are to be assumed in the calculations anywhere on the bottom of the craft as follows:

the longitudinal extent of damage is to be 10% of length L;

the transverse extent of damage is to be $0{,}2B$;

the vertical extent of damage is to be $0{,}02B$.

4.3.3 Where any damage of a lesser extent than that postulated in 4.3.1 and 4.3.2 would result in a more severe condition, then such damage is to be investigated in making damage stability and trim calculations.

4.4 Damage stability and trim of WIG craft.

.1 The angle of inclination of WIG craft from the horizontal is not to exceed 8° in any direction for all permissible loading conditions and such uncontrolled passenger movements which may occur in emergency situation.

.2 The Register may allow the angles of inclination up to 16° immediately after damage but quickly reducing to 12° (and it is proved to the satisfaction of the Register), on condition that:

suitable holding points, hand rails and efficient non-slip deck surfaces are provided;

limitation of the angle of inclination to 8° is impracticable. In exceptional cases, the Register may allow greater angles of inclination immediately after damage provided the requirement of 4.4.3 are fully met.

.3 It is to be proved that after any damage assumed in accordance with 4.3 WIG craft has sufficient stability. Damage stability elements in the final stage of flooding are to be not less than those required in 3.5.1.6 and 3.5.1.12, Part V "Subdivision" of Rules for the Classification and Construction of Sea-Going Ships .

.4 It is to be proved that after any damage assumed in accordance with 4.3 for all permissible loading conditions a possibility of timely evacuation of passengers is ensured with full guarantee that in the displacement mode:

any flooding of passenger compartments or escape routes will not significantly impede the evacuation of passengers;

essential emergency equipment, emergency radios, power supply and public address system remain accessible and operational.

4.5 Stability in case of flooding of passenger and other spaces located above the watertight deck or equivalent structure.

.1 Stability of WIG craft is to be checked for the case of flooding of the spaces located above the watertight deck or an equivalent structure.

The question whether stability of WIG craft is sufficient or not is subject to special consideration by the Register in each case.

4.6 Requirements for means of additional buoyancy.

.1 Means of additional buoyancy may be expanded foam blocks assembled in sections or covered with expanded foam. Separate air buoyancy tanks or double-skin hulls may be considered under certain circumstances as means providing buoyancy without their filling with the foam, provided WIG

craft manufacturer can confirm this by the results of testing each tank and hull for watertight integrity. Tests of the air boxes for watertight integrity are to be carried out under positive pressure 0,008 N/mm^2 which is not to be reduced below 0,007 N/mm^2 during 1 min. Big boxes subject to deformations may be tested by lower positive pressure with the testing time increased accordingly.

.2 Enclosed spaces are to be provided with adequate drainage arrangements. Closed locations which do not serve as buoyancy means but void or partially filled with expanded foam are to be opened before testing for buoyancy.

.3 Buoyancy means are to be securely fixed; they are to be so positioned and secured that not to be subject to mechanical damage.

.4 Buoyancy means are to be gasoline-resistant. Buoyancy means are to be tested in accordance with the programme approved by the Register. Changes in buoyancy qualities is not to exceed 5%. Water absorption is not to be more than 8% after 8 days under water.

.5 The requirements of 4.6.4 may be dispensed with provided buoyancy means are protected so that contact with oil fuel is prevented.

4.7 Where damage is likely to occur provided that the possibility of safe transition of WIG craft to the skimming or to the ground effect mode is not excluded and thereby its safety is improved and the independent arrival to a place of refuge or the approach to a salvage ship or reaching the shore is possible, etc, there must be given recommendations on carrying out such actions.

PART VI. FIRE PROTECTION

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 The requirements of Part VI "Fire Protection" of Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft as far as reasonable and practicable, having regard to the requirements given below.

1.2 Definitions and explanations.

1.2.1 Definitions and explanations relating to general terminology are given in Section 2, "General" of the Rules and Part VI "Fire Protection" of Rules for the Classification and Construction of Sea-Going Ships.

1.2.2 For the purpose of the Rules the following definitions have been additionally accepted:

Demonstration time is the experimental time in the course of which untrained people in a number being equal to the number of seats and the crew must escape WIG craft after fire alarm.

Material having low flames pread-char acteristics is a material thus described following the results of the test conducted in accordance with IMO Resolution A.653/16.

SECTION 2. STRUCTURAL FIRE PROTECTION

2.1 The hull of WIG craft is to be constructed of non-combustible materials having adequate structural properties and approved by the Register. The Register may allow the use of combustible materials with low flame spread characteristics provided additional structural, active and other measures which ensure the adequate level of safety are taken.

2.2 Fire-resisting divisions are to be made of a non-combustible material. The use of a combustible material covered with non-combustible insulation may be permitted. The divisions are to prevent the penetration of smoke and flame during the greater of the following periods: 30 min or thrice repeated the demonstration time necessary for embarkation into the rescue means plus 7 min for detection and extinction of fire.

2.3 Closing appliances of the openings in fire-resisting divisions are to be as effective in resisting fires as the divisions in which they are fitted. Where pipes, cables, ventilation ducts and their fittings pass through fire-resisting divisions measures are to be taken to maintain fire resistance of the latter.

2.4 The following structures are to be constructed as structures referred to in 2.2:

.1 sides, decks, bulkheads bounding machinery spaces other than structures washed with water in the displacement mode of the light WIG craft;

.2 decks and bulkheads separating control stations from the adjacent spaces.

2.5 Control stations, escape routes places where life-saving appliances are stored and places of embarkation into life-saving appliances are not to be adjacent to the machinery spaces if possible.

2.6 The main items of hull structure inside the machinery spaces are not to deteriorate when exposed to standard fire tests during the period of time referred to in 2.2.

2.7 If the structures referred to in 2.2 are made of aluminium alloys, their insulation is to be such that the temperature of the core does not rise more than 200°C above the ambient temperature during the first 30 min of the standard test.

2.8 All ceilings, grounds, linings, thermal and acoustic insulation are to be made of non-combustible materials.

The use of combustible materials not more than 1,5 mm in thickness with low flame spread characteristics is allowed for facing.

2.9 Furniture installed in WIG craft is to be constructed of non-combustible materials. However, materials used for lining and facing may be combustible materials with low flame spread characteristics.

2.10 For the purposes referred to in 2.8 and 2.9, the Register may allow to use a limited amount of combustible materials having low flame spread characteristics provided structural, active and other measures are taken to ensure the adequate level of fire safety.

2.11 Where combustible materials are used for providing watertight integrity, they are to be efficiently protected from potential sources of ignition and contamination with flammable liquids.

2.12 Spaces where smoking is allowed are to be provided with ash-trays. Where smoking is forbidden the appropriate warning notices are to be provided.

SECTION 3. FIRE FIGHTING MEANS

3.1 The following fire fighting means are to be provided on WIG craft:

.1 one fire extinguisher;

.2 one fire bucket.

3.2 Besides, a flooding fire fighting system of an approved type operated by a helmsman from WIG

craft operating compartment is to be fitted for protection of the machinery space or motor compartment. The amount of a fire extinguishing medium supplied by the system is to correspond to the size of the motor compartment with the volume of the equipment installed in the compartment deducted.

PART VII. MACHINERY INSTALLATIONS

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 This Chapter applies to WIG craft machinery installations, machinery and equipment of machinery spaces, gears, shafts and propellers providing lift and propulsion.

1.1.2 Petrol engines in an enclosed engine compartment may be used in WIG craft.

1.2 General requirements.

1.2.1 It is recommended that engines should be provided with adequate means for heating or facilitation of engine starting in cold seasons.

1.2.2 The engine compartment is to be fitted with forced or natural ventilation capable to supply the necessary amount of air for engine operation and ventilation of the engine compartment. The temperature in the engine compartment is not to exceed 70°C.

1.2.3 Bilge water may be drained only to reception facilities, for which drain holes are to be fitted with plugs or shut-off fittings.

1.2.4 Engine controls are to be conveniently arranged at the control station.

1.2.5 In amphibian WIG craft engine, gears, systems and air propellers are to be arranged so as to be readily accessible for inspection on the shore site.

1.2.6 Provision is to be made for guard rails to prevent accidental access of people to a dangerous area during operation of air propellers.

1.3 Power output of WIG craft main engines.

1.3.1 The power output of main engines is to be such that no overload exceeding that specified in the engine documentation could occur during transition of WIG craft into the ground effect mode under the worst intended conditions.

1.4 Control stations.

1.4.1 All operations on engine and machinery control are to be performed from one control station.

1.4.2 Provision is to be made for devices independent of the remote control system for the safe transfer of WIG craft to the displacement mode.

1.4.3 Where provision is made for machinery control from a special station, in addition to WIG craft control station, control from one station to the other is to be transferred from WIG craft control station.

1.4.4 The number of instruments is to be kept to a minimum necessary for the safe operation.

SECTION 2. GEARS AND SHAFTS

2.1 The design is subject to special consideration by the Register.

SECTION 3. PROPELLERS

3.1 The design of air and other propellers is subject to special consideration by the Register.

PART VIII. SYSTEMS AND PIPING

SECTION 1. GENERAL

1.1 Scope of application.

This Part of the Rules covers the following systems and piping:

bilge system;

oil fuel system;

exhaust gas system;

ventilation system;

hydraulic system.

1.2 General requirements.

1.2.1 Pipes are to be capable to withstand prolonged exposure to vibration.

1.2.2 Pipes are to be provided with arrangements for drainage and purging of the conveyed medium.

1.2.3 Along with a head in the overflow condition, tanks and reservoirs are to be capable to withstand dynamic loads arising from WIG craft motion. This is to be confirmed by a hydraulic test with an appropriate pressure. Securing devices and foundations of the tanks and reservoirs are to be designed for the same loads.

1.2.4 Constructional measures are to be taken to avoid the impingement of flammable liquids on likely sources of ignition.

1.2.5 As regards materials, fabrication and use, pipes and fittings are to comply with the requirements of 1.3.1, Part VIII " Systems and Piping" of Rules for the Classification and Construction of Sea-Going Ships.

1.2.6 Plugs and threaded portions of sounding pipe deck sockets on open decks are to be made of copper or brass. The use of other materials is subject to special consideration by the Register.

1.2.7 Flexible joints are to be used to provide flexibility of pipe connections with engines and machinery in case of their installation on dampers or in other necessary cases. The type and design of flexible joints are to comply with 1.3.1.8, Part VIII "Systems and Piping" of Rules for the Classification and Construction of Sea-Going Ships. Flexible joints are generally to be supplied as fabricated inserts with connecting items (flanges or screwed nipple unions). Exception may be made for flexible joints of Class III pipes conveying flammable medium. The length of the inserts is to be kept to a minimum.

1.2.8 Pipes and tanks where a pressure exceeding the design pressure is likely to arise are to be fitted with safety devices.

SECTION 2. BILGE SYSTEM

2.1 Each WIG craft is to be provided with one hand bilge pump. This pump is to be kept outside the engine compartment. Provision is to be made for drainage of any watertight compartment using the pump.

2.2 The capacity of the hand bilge pump is to be not less than that indicated in Table 2.2.

Table 2.2

Length of WIG craft	Pump capacity, litre/piston stroke
Less than 8	0,6
8 — 10	0,9
More than 10	1,2

2.3 For WIG craft more than 10 m an electrically or engine-driven pump is to provided in addition to the hand pump. The pump is to be installed in the engine compartment. The capacity of the pump is not to be less 10 m^3/h. The pump is to be capable to drain the engine compartment and spaces adjacent thereto. The water cooling pump may be used as a bilge pump.

2.4 Valves of the bilge pump are to be readily accessible.

SECTION 3. OIL FUEL SYSTEM

3.1 Oil fuel storage.

3.1.1 Oil fuel is to be stored in independent tanks. Exception may be made for oil fuel tanks arranged in the wings of WIG craft.

3.1.2 Independent oil fuel tanks are to be placed in a separate compartment separated from the engine and accommodation compartments by a gastight bulkhead and be provided with an independent natural ventilation system capable to remove oil fuel vapours from any point of the compartment.

3.1.3 Compartments for installation of oil fuel tanks and oil fuel tanks built in the wings of WIG craft are to have a weak hull member positioned so that in case of an oil fuel tank explosion, an explosion wave is directed away from the engine and people. The deck and bulkheads separating the oil fuel tank compartment from the engine and accommodation compartments are to have adequate strength to

withstand explosion of the oil fuel tank. Fire resistance of such decks and bulkheads is to comply with 2.2, Part VI of the Rules.

3.1.4 For oil fuel tanks intended for storage of oil fuel with flash point 60°C the requirements of 3.1.1, 3.1.2 and 3.1.3 are of recommendation nature. Where an oil fuel tank is located in the engine compartment, it is not to be placed above the engine and equipment with a surface temperature under the insulation in excess of 220°C and is to be as remote therefrom as practicable.

3.1.5 Oil fuel tanks are to be made of materials resisting to exposure of oil fuel, sea water and not prone to cracking. The design and tests of plastic tanks are subject to special consideration by the Register. Plastic is to be electrically conductive.

3.1.6 Oil fuel tanks are to have adequate strength and rigidity. Oil fuel tanks of more than 50 litres in capacity are to have longitudinal inner bulkheads with openings at the top and at the bottom between tank compartments.

3.1.7 The oil fuel tank is to be fitted with a level gauge with an indication on the navigator's instrument panel. The level gauge of the tank is to be intrinsically safe.

3.1.8 A self-closing valve with a threaded plug is to be fitted for draining sediment from the oil fuel tank.

3.1.9 Each oil fuel tank and compartment of the oil fuel tank are to be provided with a sounding pipe led to the open part of the deck. Air pipe outlets of the oil fuel tank and the oil fuel tank compartment are to be separate and to have air heads fitted with flame-arresters. The height of the air pipes of the oil fuel tanks is to be such that a possibility of spilling oil fuel and getting water therein under any operational conditions is precluded.

3.1.10 Irrespective of the material of oil fuel tanks, they are to have earthing devices for discharge of electrostatic charge and even distribution thereof over the craft hull. The hull of the craft is to have earthing in the displacement and transitional modes.

3.2 Detachable oil fuel tanks.

3.2.1 A suitable place with securing devices for detachable oil fuel tanks is to be provided on WIG craft with outboard engines of 4 kW capacity and over. The place for engine installation is to be arranged so that the tank can be easily installed and removed. The space for storage of detachable oil fuel tanks is to comply with 3.1.2 and 3.1.3.

3.2.2 Reserve tanks are to be provided with securing devices.

3.2.3 Tanks having a capacity over 25 litres are to be stationary.

3.3 Oil fuel pipes.

3.3.1 Oil fuel pipes are to be made of steel or other material which fire resistance meets the requirements for L1 level according to IMO Resolution A.753(18) for plastic pipes.

3.3.2 Oil fuel pipes and equipment are not to break and leak when exposed to vibration and impacts likely to arise in operation.

3.3.3 Pipes are to be readily accessible for inspection over the entire length. The number of detachable joints is to be kept to a minimum. No gaskets are to be used in the joints.

3.3.4 Oil fuel pipes and their fittings are to be positioned on the engine side opposite to the exhaust pipe.

3.3.5 The supply pipe from the oil fuel tank is to be provided with a quick-closing valve with a remote control led to the control station. The requirements of 1.8.3, Part VII " Machinery Installations" of Rules for the Classification and Construction of Sea-Going Ships are to be met. The quick-closing valve is to be installed directly on the tank wall.

3.3.6 Oil fuel pipes are not to be laid over the engine, exhaust pipes, electrical and other equipment which can be a source of ignition and are to be as remote therefrom as possible. In exceptional cases, installation of oil fuel pipes over the exhaust pipe is allowed, provided the oil fuel tank has no detachable joints in this area or is screened and trays are fitted in appropriate places to prevent oil fuel penetration to sources of ignition.

3.3.7 Provision is to be made to drain all oil fuel and lubricating oil leakage to a safe position or a special tank fitted with a flame-arrester so as to avoid a fire hazard in the engine compartment,.

3.3.8 Measures are to be taken for uniform consumption of oil fuel from oil fuel tanks to prevent hazardous heeling moments in the ground effect mode.

3.4 Fuelling system.

3.4.1 Each tank is to have separate filling and air pipes. Inlet pipes of oil fuel tanks and vents are to be positioned not closer than 1,0 m from an air inlet and gas exhaust of the engine. Inlet pipes of oil fuel tanks are to be constructed so that any possibility of oil fuel and its vapour penetration into the craft hull is prevented. The requirements of 5.1 and 5.3, Part VIII "Systems and Piping" of Rules for the Classification and Construction of Sea-Going Ships are to be met.

3.4.2 The fuelling system is to be provided with a readily accessible water separator. In case no separator is available, fuelling is to be performed through a funnel with a water separating gauze (with 0,5 mm mesh).

3.4.3 The pipe is to be fixed and protected to prevent mechanical damage or wear. Pipes are to be provided with expansion joints. Different materials which can cause contact corrosion are not to be used in the oil fuel system.

3.4.4 Hoses are to be capable to withstand a pressure of 0,5 MPa at a temperature 60°C. Before the commencement of tests the hose is to be kept filled with oil fuel for 7 days. The breaking pressure of hoses is to be at least four times greater than the design pressure.

3.4.5 After assembling the oil fuel system is to be tested for tightness under operational conditions in the presence of a surveyor to the Register.

SECTION 4. EXHAUST GAS SYSTEM

4.1 The requirements of 6.1.1, 6.1.2 and 6.1.7, Part VIII "Systems and Pumping" of Rules for the Classification and Construction of Sea-Going Ships are to be met.

4.2 Exhaust gas systems are to be installed so that any possibility of exhaust gas penetration into the spaces where people may be present, and also into the air-conditioning system, air intakes of engines and oil fuel tank vents is precluded.

4.3 Exhaust gas pipes are to be so arranged that any possibility of fire is precluded. For that purpose all structures located in vicinity of the exhaust gas system as well as those which are likely to be exposed to high temperatures of exhaust gases under all operational conditions are to be made of non-combustible materials or properly screened.

4.4 The design and arrangement of exhaust gas manifolds or jet nozzles are to provide safe gas exhaust.

SECTION 5. VENTILATION SYSTEM

5.1 Ventilation ducts intended for removal of explosion- and fire-dangerous vapours and gases are to be gastight and are not to communicate with ventilation ducts of the spaces which do not contain such vapours and gases.

5.2 Vent heads and air intakes of the supply ventilation system are to be so positioned that any probability of suction of the air contaminated with oil gases, vapours, etc is kept to a minimum and a possibility of sea water penetration into ventilation ducts is precluded.

5.3 Ventilation of machinery spaces is to provide adequate supply of air for operation and maintenance of machinery under all operational conditions of WIG craft. Ventilation of the engine compartment to provide operation of the engine and its ventilation is to be arranged with regard to manufacturer's requirements.

5.4 Ventilation system is to have separate ducts for air supply and exhaust. Air suction and discharge ducts are generally to be located in the opposite ends of the space, the air being sucked in the lower part of the space.

5.5 Enclosed compartments for petrol engines and oil fuel tanks are to be provided with natural, and supply and exhaust ventilation. Ventilation system of machinery space is to have separate supply and exhaust ducts.

Natural ventilation ducts are to have a cross-section, cm^2:

$$F = 40V \text{ but not less than } 45 \text{ cm}^2$$

where V = volume of the ventilated space (machinery and equipment excluded), m^3.

For compartments of a complex-shaped form or where long ventilation ducts are required, greater cross-sections or special ventilator heads may be needed.

5.6 Spaces for petrol engines installed inside WIG craft are to be provided, in addition to the natural ventilation, with the forced exhaust ventilation with the capacity, m^3/min:

$$Q = 1{,}5V \text{ but not less than } 1{,}5 \text{ m}^3/\text{min}.$$

Ventilators of the exhaust ventilation are to be of intrinsically safe design. The electric motor of the ventilator is to be of a safe type and be located beyond the exhaust gas flow. Operation of the ventilator is to be controlled from the control station. The ventilator is to be started at least 2 min before the engine.

5.7 Spaces for petrol portable oil fuel tanks are to be provided with two ventilation openings with a section of at least 20 cm^2 connecting the compartment with atmosphere.

5.8 The engine compartments with petrol engines, spaces containing independent oil fuel tanks which are adjacent to passenger spaces are to have gastight bulkheads to prevent spread of oil fuel vapours from these spaces.

5.9 Ventilation system of accumulator battery rooms and boxes are to meet the requirements of 7.10, Part VIII "Systems and Piping" of Rules for the Classification and Construction of Sea-Going Ships.

5.10 The ends of the suction pipes of carburattors are to be fitted with special heads provided with flame screens and preventing water penetration. Flame arresting fittings are to be be provided in enclosed engine compartments where no suction pipes are installed at the air intake to the carburattor.

SECTION 6. HYDRAULIC SYSTEM

6.1 The requirements of 7.2 and 7.3, Part IX "Machinery" of Rules for the Classification and Construction of Sea-Going Ships are to be met.

6.2 Hydraulic fluids are to comply with the requirements of 2.3.11, Part XV "Automation" of Rules for the Classification and Construction of Sea-Going Ships.

6.3 Hydraulic system is to be provided with an effective cooling system.

PART IX. MACHINERY

SECTION 1. GENERAL

1.1 Scope of application.

This Part of the Rules applies to engines, gears, couplings and drives.

1.2 General requirements.

1.2.1 The design of machinery is to be such as to minimise the risk of fire or explosion.

1.2.2 Machinery, gears and securing devices are to have adequate strength and soundness which allow to withstand the most adverse combination of inertia, vibration, gyroscopic and other loads likely to arise under any operational conditions, including possible failures, abrupt transition to the displacement mode or grounding. The accelerations assumed in the calculations are not to be less than $2g$ and allowable total stresses are not to exceed 0,95 of the yield point of the parts material.

1.2.3 Failure of the machinery driven from the engine is not to result in the failure of the engine itself.

1.2.4 Departures from requirements of the Rules are subject to special consideration by the Register.

1.2.5 The design of high-speed machinery is to allow for all factors affecting their fatigue strength. Reliability of the items is to be confirmed by tests and/or by assuming fairly high factors of safety ($K > 1,5$).

SECTION 2. ENGINES

2.1 The engine design is to allow the control of the power output within the approved limits.

Each main engine is to be equipped with an overspeed protective device, connected directly, where possible, to the engine shaft, to prevent the exceeding of the maximum permissible speed.

2.2 Each main engine is to have a speed governor so adjusted that the engine speed cannot exceed the design (nominal) speed by more than 15%.

2.3 All the machinery is to operate reliably under all external conditions, lists, trims and changes of WIG craft speed likely to occur in normal operation in compliance with the design documentation.

2.4 Where more than one engine is used, their auxiliary systems are to be designed so that failure of one engine will not affect the operation of the other one.

SECTION 3. MECHANICAL AND HYDRAULIC DRIVES

3.1 Hydraulic drives.

3.1.1 Hydraulic drives are to comply with the requirements of 7.2, 7.3.1 to 7.3.5, Part IX "Machinery" of Rules for the Classification and Construction of Sea-Going Ships.

3.2 Drives and gears for propulsion, control and lift arrangements of WIG craft.

3.2.1 Gears of propulsion arrangements (air blowers, propellers, etc.) are to comply with the requirements of 4.1, 4.2 and 4.3, Part IX "Machinery" of Rules for the Classification and Construction of Sea-Going Ships.

3.2.2 Inertia loads in the gear are not to cause any hazard under any operational conditions.

3.2.3 Where a torque-limiting clutches are fitted in the gear, they are to operate when a torque exceeding the design value by 35% arises. In case torque-limiting clutches are used as a means to reduce dynamic stresses caused by torsional vibrations, the operation moment of the clutch is taken as a sum of the average torque and alternating moment because of torsional vibrations, based on the drive strength condition.

3.2.4 The controls which ensure WIG craft propulsion in all modes and their guards are to be readily accessible for inspection in operation. Their design is to preclude an emergency situation associated with WIG craft flooding in case of collision with floating objects.

3.2.5 The design of the controls which ensure lift, take-off/landing and motion of WIG craft is to pay due regard to the effects of allowable corrosion, electrolytic action between dissimilar metals, as well as erosion or cavitation which may result from operation in environments in which they are subjected to spray, salt, sand, icing, etc.

3.2.6 The design strength of the controls which ensure WIG craft propulsion in all modes is to be confirmed by hydraulic tests. The test pressure is to be not less than the maximum pressure likely to arise in operation.

3.3 Steering gear.

3.3.1 Steering gear is to comply with the requirements of 6.2.1.1, 6.2.1.3, 6.2.4.2, 6.2.9, Part IX "Machinery" of Rules for the Classification and Construction of Sea-Going Ships.

3.3.2 The power of the main steering gear is to provide putting the rudder over from one side to the other side according to 2.3.2.14 of Rules for Dynamically Supported Craft.

3.3.3 Provision is to be made for inspection and repairs of rudder control systems necessary in service.

3.3.4 The power of the auxiliary steering gear is to provide putting the rudder over from one side to the other side in compliance with 2.3.2.15 of Rules for Dynamically Supported Craft.

3.3.5 The design and characteristics of the air propeller tilt mechanism, tilt pylons, tilt flaps and wings as well as other stabilisation control devices are subject to special consideration by the Register.

PART X . HEAT EXCHANGERS AND PRESSURE VESSELS

The requirements of Part X "Boilers, Heat Exchangers and Pressure Vessels" of Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft as far as reasonable and practicable.

PART XI. ELECTRICAL EQUIPMENT

SECTION 1. GENERAL

1.1 Scope of application.

All applicable requirements of Part XI "Electrical Equipment" of Rules for the Classification and Construction of Sea-Going Ships, unless provided otherwise in this Part, apply to electrical installations and individual items of electrical equipment of WIG craft.

1.2 Definitions and explanations.

.1 Definitions and explanations relating to the general terminology are given in "General" of the Rules and in Part XI "Electrical Equipment" of Rules for the Classification and Construction of Sea-Going Ships.

1.3 Scope of supervision.

.1 Essential electrical equipment of WIG craft the normal operation of which ensures safety of navigation, people and cargo on board is subject to supervision. Items referred to in 2.5 refer to such electrical equipment.

.2 Electrical equipment is to have the Register documents which confirm supervision during its manufacture. The electrical equipment which has no documents confirming supervision during its manufacture is to be tested and surveyed in accordance with the programme approved by the Register before installation on WIG craft.

SECTION 2. GENERAL REQUIREMENTS

2.1 The WIG craft electrical installation is to be designed and installed so that failure of any item of machinery or control system does not cause emergency situations to the whole WIG craft.

2.2 Depending on the place of installation use is to be made of electrical equipment with safety enclosure specified in Table 2.4.4.2, Part IX "Electrical Equipment" of Rules for the Classification and Construction of Sea-Going Ships or other precautions are to be taken to protect the equipment from adverse effects of the environment and to ensure protection of passengers, crew and craft from electrical hazards.

2.3 Operational conditions.

.1 Design, installation and arrangement of electrical equipment are to ensure its proper operation at the worst angles of list and trim likely to arise under the worst intended conditions, including emergency conditions.

.2 Electrical equipment is to operate reliably under conditions listed in 2.1, Part XI "Electrical Equipment" of Rules for the Classification and Construction of Sea-Going Ships.

2.4 Arrangement of electrical equipment.

.1 Electrical equipment is to be installed so that controls are readily accessible.

.2 Electrical equipment is to be reliably attached in regular places. Precautions are to be taken to prevent electrical equipment attachement devices from loosening. Materials used for attachement devices of electrical equipment and cables are not to cause electrical corrosion of hull structures and the material of attachement devices itself.

.3 The installation of lighting fixtures is to be such as to prevent heating of cables and adjacent materials to a temperature exceeding the allowable value.

.4 An emergency source of electrical power is to be installed outside machinery spaces where main machinery and main sources of electrical power are installed.

The provisions are to be made that spaces containing emergency sources of electrical power do not have adjacent bulkheads with the above-mentioned machinery spaces and other fire-hazardous spaces.

2.4.5 Accumulator batteries used as an emergency source of electrical power are to be located in a space in accordance with 2.4.4 of this Part of the Rules and 13.2, Part XI "Electrical equipment" of Rules for the Classification and Construction of Sea-Going Ships.

.6 The main and emergency switchboards are to be so arranged that failure of one of the switchboards will not affect the other switchboard.

2.5 Essential electrical equipment.

The following equipment is referred to essential electrical equipment:

the main source of electrical power;

emergency source of electrical power;

power transformers, electrical power converters;

switchgear, control stations;

electric drives of machinery servicing main machinery, steering gear (hydraulic and air rudders, wing struts, pylons, etc), stabilization machinery and devices, anchor and mooring arrangements, machinery of tractor propellers, air compressors, air blowers, bilge pumps, fans of spaces;

main and emergency lighting, navigation and flashing lights;

service telephone and loud-speaking communication, sound signal means;

general alarm, fire alarms, alarm on fire smothering agent release;

charging facilities for accumulator batteries.

SECTION 3. MAIN SOURCE OF ELECTRICAL POWER

3.1 Composition and capacity of the main source of electrical power.

.1 Each WIG craft is to be provided with the main source of electrical power.

.2 The main source of electrical power may be either:

generators driven by main engines;

accumulator batteries.

3.1.3 Generators and accumulator batteries may be used as the main source of electrical power in any combination.

3.1.4 The number and capacity of generators and accumulator batteries used as the main source of electrical power are to be such that in case of failure or malfunction of one of them the remaining sources will be capable to supply essential services necessary for normal operational conditions of propulsion, steering and safety of WIG craft.

3.1.5 Where accumulator batteries are the main source of electrical power, provision is to be made to charge them from the electrical power source installed on WIG craft.

3.1.6 Where an accumulator battery is used in parallel with a generator and the capacity of each of them is sufficient to supply essential services necessary for the normal operational conditions of propulsion, control and safety of WIG craft, the requirement of 3.1.4 is considered to be met.

3.1.7 In parallel operation of a generator with an accumulator battery, the generator is to be provided with such voltage controller that the charging current of the accumulator battery does not exceed the allowable value. The capacity of the generator operating in parallel with the accumulator battery is to be such that supply of all services and charging of the accumulator battery are ensured under normal operational conditions (see also 3.1.4).

SECTION 4. EMERGENCY SOURCE OF ELECTRICAL POWER

4.1 There must be an emergency source of electrical power in any craft.

4.2 The emergency source of electrical power is to be an accumulator battery which is to be capable of automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power.

4.3 The capacity of the accumulator battery is to be sufficient to supply essential services for at least two hours and to supply the lights of "Vessel not under command" signal for at least 12 hours.

4.4 Where the main source of electrical power consists of generator driven by a prime mover and an accumulator battery which operate in parallel with the generator, the above-mentioned accumulator battery may be used as an emergency source of electrical power, provided it is installed in compliance with 2.4.4.

SECTION 5. DISTRIBUTION OF ELECTRICAL POWER

5.1 12 V D.C. and 24 V D.C. may be used in electrical installations of WIG craft.

5.2 All essential services are to be supplied by separate independent feeders from switchboards.

Tilt control systems for propellers and flaps, blowing of air damping devices are to be supplied by a common feeder.

5.3 Main and emergency supply of essential services is to be provided from the switchboard of the main source of electrical power and from the emergency switchboard.

5.4 During normal operation of the propulsion plant the parallel connection of generators and accumulator batteries to the switchboard busbars is to be provided. In case of failure of the generator it is to be automatically disconnected.

5.5 Each circuit outgoing from the switchboard is to be provided with a switch disconnecting all the poles and/or phases and have a short-circuit protection in each separated pole and/or phase.

5.6 Generators are to have protection from short-circuit, overload and from minimum voltage. Accumulator batteries are to have short-circuit and overload protection. Protection devices are to be located on the switchboards of the generators and/or accumulator batteries.

5.7 Cables.

.1 Cable conductors with a cross-sectional area of not less than 0,5 mm^2 may be used for internal cabling of control stations and switchboards, and not less than 0,35 mm^2 for control and measuring circuits.

.2 Cable conductors with a cross-sectional area of not less than 0,5 mm^2 may be used for external cabling of control and signalling circuits.

SECTION 6. ACCUMULATOR BATTERIES

6.1 General requirements for installation and location of accumulator batteries.

.1 Accumulator batteries are to be of such a type that after 28 days of staying without a load at

temperature $25 \pm 5°C$ the loss of capacity because of self-discharge does not exceed 30% of nominal capacity for acid accumulator batteries and 25% of nominal capacity for alkaline accumulator batteries.

.2 The spaces and boxes for installation of accumulator batteries are to be constructed of durable materials resistant to electrolyte and its vapours.

.3 Accumulator batteries are to be securely fixed to prevent them from shifting during ship motions.

.4 No accumulator battery is to be installed in the same space as oil fuel tanks.

.5 Accumulator batteries are to be installed so that they are protected from the effect of water and mechanical damages, and cannot adversely affect the adjacent equipment, and are readily accessible for servicing.

.6 Accumulator batteries are to be installed so that the height from the deck to the plugs does not exceed 1500 mm.

.7 Where accumulator batteries are installed in a row, provision is to be made for linings and spacers between them that will ensure a clearance at least 15 mm for air circulation from all sides.

.8 Warning notices indicating a hazard of explosion are to be provided on the doors of accumulator batteries rooms and boxes.

.9 Accumulator battery rooms and boxes where temperatures down to 5°C are likely to be encountered while operation are to be heated. Heating may be provided using the adjacent spaces heat, or water or steam radiators placed inside the accumulator battery rooms.

.10 Air-conditioning system may not be used for heating accumulator battery rooms.

.11 Accumulator battery rooms and boxes are to have adequate ventilation preventing the generation and accumulation of explosive vapours. The ventilation system is to comply with the requirements of 6.8, Part VIII "Systems and Piping" of Rules for the Classification and Construction of Sea-Going Ships.

.12 Acid and alkaline accumulator batteries are not to be placed in the same room or box.

6.2 Requirements for electrical equipment installed in accumulator battery rooms and boxes.

.1 No electrical equipment other than lighting fixtures of a safe-type and cables led to the lighting fixtures and accumulator batteries may be installed in accumulator battery rooms.

The type of the cables used for connection of accumulator batteries and lighting fixtures is to comply with the requirements of 2.9, Part XI "Electrical Equipment", of Rules for the Classification and Construction of Sea-Going Ships.

6.3 Characteristics of accumulator batteries for electric starting of internal combustion engines.

.1 In WIG craft where internal combustion engines with electric starting are installed, only one starter battery may be used, provided it can be utilized for starting all the engines.

.2 The starter battery is to be designed to withstand the discharging current in the starter duty that will correspond to the maximum current through the most powerful starting electric motor.

.3 The capacity of the battery is to be sufficient for at least six starts of an internal combustion engine with an interval between starts not less than 1 minute, and where two or more engines are used, at least three starts of each engine.

.4 The starting battery is to be charged from the generator operating in parallel with the accumulator battery.

.5 For starting the engine the accumulator battery of the emergency source of electrical power may be used, provided its capacity will be sufficient both for supplying the services in accordance with 4.3 and for starting internal combustion engines in accordance with 6.3.3 of this Part of the Rules.

SECTION 7. SPARE PARTS

7.1 The nomenclature and number of spare parts are to be determined by the designer of the craft and are subject to special consideration by the Register.

PART XII. REFRIGERATING PLANTS

The requirements of Part XII "Refrigerating Plants" of Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft as far as reasonable and practicable.

PART XIII. MATERIALS

The requirements of Part XIII "Materials" of Rules for the Classification and Construction of Sea-Going Ships apply to WIG craft as far as reasonable and practicable.

PART XIV. HULL FORMATION

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 This Part of the Rules sets forth the requirements and standards which are to be met by WIG craft hull structure formation technology.

1.1.2 In case constructional solutions, and hull strength and vibration calculation procedures other than described in this Part are used, it is to be proved to the Register by a calculation or experimentally that at least the same level of safety is ensured.

1.1.3 For the hull structures formation sandwich constructions made of glass-reinforced plastic panels and glass-reinforced plastic are used.

Aluminium and titanium alloys and other materials may be used as materials for shell plating, essential mounts and parts of WIG craft. For parts made of such materials the structural sections are to be chosen in accordance with Rules for the Classification and Construction of Sea-Going Ships; the design of connections and processing technique are to comply with recognized standards.

1.1.4 The first WIG craft of the series is to be tested according to the programme approved by the Register. The scope of measurements and tests is to be sufficient to make a reliable conclusion on strength of the hull and all its members. The test results are to be submitted to the Register.

The Register reserves the right to require additional tests of WIG craft in case of alterations made in the design of hull members which may affect the safety of the craft.

SECTION 2. TECHNIQUE

2.1 Production conditions and quality of formation.

2.1.1 Production spaces.

.1 Production spaces are to be equipped and arranged so that instructions of material suppliers can be followed as regards processing of the materials, process of formation of sandwich constructions and moulding conditions.

.2 Air temperature in the moulding space is to be not less than $+18^{\circ}C$. This minimum temperature is to be maintained during at least 24 hours before the beginning of the laminate formation, whatever a temperature of outside air may be. The temperature in the moulding spaces may be changed by not more than $\pm 3^{\circ}C$ during 24 hours.

.3 The relative humidity is to be maintained as constant as possible to preclude condensate and it is not to exceed 80%. In places where hull is moulded by spraying, air humidity is not to be less than 40%, whatever temperature and relative humidity of the outside air may be.

.4 No air draught through doors or windows and direct sun-rays are allowed in spaces where a construction is moulded.

.5 Production spaces are to be kept clean and contain no dust as far as possible to prevent raw materials and moulds from contamination.

.6 Ventilation system is to be designed so that it cannot affect a moulding process.

2.1.2 Storage spaces.

.1 Storage spaces are to be equipped and arranged so that the requirements of the material suppliers for storage and handling of raw materials can be met.

.2 Storage spaces for glass-reinforced plastic are to be clean (contain no dust) as far as possible to prevent raw materials from contamination. Glass-reinforced plastic rolls are to be protected from rain and moisture.

.3 Binder components, gel coat and similar materials are not to be kept at temperatures which can affect material properties. Raw materials which are stored at temperatures below $+18^{\circ}C$ are to be heated before use to a temperature of the moulding shop. Vessels for polyesters are to be made and fitted so that their contents can be shaken and mixed every day.

.4 Before moulding glass-reinforced plastic is to be kept for at least two days in storage spaces with a lower relative humidity than that in production

spaces and at a temperature by +2°C higher than in production spaces, when possible. Where such storage of the glass-reinforced plastic before being moved to the production space is impracticable, the material is to be kept for at least two days under the same conditions as those in the moulding space.

2.1.3 Materials.

.1 WIG craft hull structure is made either of panels of composite laminates which are sheets of reinforcing fibres (glass cloth and carbon tape) interconnected by an adhesive matrix with stiffeners or sandwich constructions with a core of honeycomb structure of different materials, plastic foam, polyurethane foam and outer skins are made of a glass cloth or a carbon tape.

.2 Raw materials are to be supplied in compliance with Part XIII "Materials" of Rules for the Classification and Construction of Sea-Going Ships.

.3 In the part of the hull contacting with water, a reinforcing layer next to the gel coat is to contain as few water-soluble components as possible.

.4 WIG craft manufacturer is to keep the documentation on raw materials which can be submitted on surveyor's request.

.5 Storage temperatures and storage periods for adhesive components are to be within the limits specified by the material supplier.

.6 Curing systems (composites) are to be chosen with due regard for chemical activity in accordance with supplier's instructions. Heat processes during curing are to be maintained at a safe level. The amount of the curing agent is to be within the limits specified by the supplier.

.7 The use of hard wood as filler of a sandwich panel and in stiffeners is to be avoided. Wood is not to be used in load-bearing members of the hull structure.

2.1.4 Quality of formation.

.1 The thickness of gel coat is to be not less than 0,3 mm and generally is not to exceed 0,6 mm. Gel coat is to be applied by spraying. After application gel coat is not to spread down. The curing period of gel coat before placing the layers is not to exceed 24 hours. No gel coat is required if a multi-layer material has an equivalent coating.

.2 Structural members are generally moulded by manual application or by spraying. Other methods of formation may be used, provided extensive tests with positive results have been carried out.

.3 Essential hull members moulding is to be performed only by qualified workers under supervision of an experienced foreman. The foreman is to guarantee formation of products in compliance with the requirements of the Rules.

.4 Large structural components are to be securely fixed after extraction from a mould.

.5 Moulding of stiffeners, their placing, etc are to be made when the material is wet, if possible. The laminate which has been cured during more than 24 hours is to be cleaned to remove likely wax coating and polished so that fibres appear before moulding of the structure will be continued.

.6 Provision is to be for an appropriate protective coating (e.g., a top coat) for laminates exposed to water. Stiffeners and components which have been placed inside these laminates are to have an adequate layer of such coating. Edges of the laminate exposed to water are to be sealed with a top coat 0,3 mm thick or with an equivalent material.

.7 Upon the moulding completion, the structure is to be cured for at least 24 hours at an air temperature not below +18°C. Curing at higher temperatures and reduction of the curing time may be allowed only if the curing rate is monitored.

2.1.5 Manual moulding.

.1 Glass fabric (carbon tape) is to be laid only in an approved sequence.

.2 Where two layers of glass fabric (carbon tape) are placed, the overlapping is to be at least 50 mm.

.3 Epoxies are to be applied on each reinforcement layer before the next layer is placed. Based on the positive results of the material tests, it may be allowed to place two or more reinforcement layers before each finished rolling. The layers are to be rolled with care, special attention being paid to sharp corners and transitions.

.4 The time interval between application of each reinforcement layer is to be within the limits specified in the process instructions. Care is to be taken in handling thicker laminates, an adequately long time interval is to be provided to avoid generation of excessive heat.

2.1.6 Moulding by spraying.

.1 The term "moulding by spraying" means simultaneous application of the binder and reinforcement by glass-fiber. WIG craft manufacturers using this technique are to obtain a special approval.

.2 When the moulding process by spraying is considered, the special attention is to be given to the production equipment, ventilation equipment, internal quality control of formation and other factors which affect quality of the finished product.

.3 Hull components are to be moulded only by operators (qualified workers) specially approved for such jobs.

.4 Equipment used for moulding by spraying is to provide application of a flat and uniform laminate. All proportioning devices are to ensure precise addition of reinforcing fillers to a polyester polymer. Glass fiber is not to be shorter than 20 mm.

.5 In moulding by spraying the uniform application onto the entire surface is to be ensured. Sprayed

layers are to be regularly rolled. After application of the gel coat the final laminate is to be rolled for a thickness 1,5 mm of the thickness of the final material, and then, each time, for at least 2,5 mm of the laminate thickness. The rolling is to be carefully performed to ensure uniform compacting and removal of gas and air pockets. Special attention is to be paid to sharp corners and transitions.

2.1.7 Moulding of sandwich constructions.

.1 A sandwich construction can be made by moulding laminate on the core or by laying a core material on the wet laminate. The core binder for the cured laminate is to be considered in each particular case.

.2 The production process and quality of formation are to be such that gaps or places of connections in the core material are filled with a polyester, binder or core materials.

.3 The outer skin of a sandwich construction is to be cured before laying the core thereupon.

.4 Upon hull formation completion, the ultimate tensile strength of the material is not to deviate by more than 20% from the value indicated in the certificate. The average of five test specimens is to be used as the base value.

.5 The most strained constructions are not to have sharp stress raisers. The radius of curvature on the inside is not to be less than the double thickness and that on the opposite side, not less than five thicknesses according to the requirements of the Rules. The stress raisers may be preserved, provided special reinforcements which reduce stress concentrations are made.

2.1.8 Supervision over production.

.1 The production of polymer sandwich constructions for certified WIG craft is subject to sample verification.

.2 The intervals between the verifications depend on the production reliability which depends on the production process.

.3 Foam plastic used in load-bearing constructions is to meet the requirements of Part XIII "Materials" of Rules for the Classification and Construction of Sea-Going Ships.

SECTION 3. CONTROL

3.1 Production control.

3.1.1 The manufacturer is to have an efficient quality control system to ensure that all elements of the production process comply with the above-mentioned requirements.

3.1.2 At each stage of the production process the documents (instructions, drawings, etc) which allow to control the fulfilment by each worker of the requirements of the approved standard specifications are to be available.

3.1.3 Control results are to be recorded in a log-book. Each component or assembly is to be marked with an appropriate identification number.

3.1.4 A person responsible for quality control has to have an adequate competence to assess the quality of formation and quality of constructions made of glass-reinforced plastics.

3.1.5 The quality control system is to include the following control programmes:

raw materials;

storage and production conditions;

quality of formation of laminate and a core;

compliance with the building specification.

3.1.6 Upon extraction from moulds each moulded part is to be weighed and its thickness is to be verified according to the approved dimensions.

PART XV. AUTOMATION

SECTION 1. SCOPE OF APPLICATION

1.1 This Part of the Rules applies to automated systems of WIG craft and to individual items of automation equipment.

1.2 Along with the requirements of this Part of the Rules, all applicable requirements of Part XV "Automation" of Rules for the Classification and Construction of Sea-Going Ships apply to automated systems of WIG craft and to individual items of automation equipment.

SECTION 2. DEFINITIONS AND EXPLANATIONS

2.1 Definitions and explanations relating to general terminology are given in Section 2, "General" of the Rules and in Part XV "Automation" of Rules for the Classification and Construction of Sea-Going Ships. For the purpose of the Rules the following additional definitions have been adopted:

.1 Stabilization control system means a system intended to stabilize the main parameters of the craft's attitude: heel, trim, course and height.

.2 Automatic stabilization system means a system providing automatic stabilization of the parameters of the craft referred to in Table 6.1.

.3 Self-stabilization system means stabilization ensured solely by the craft's inherent characteristics (hull, wings, etc).

.4 Remote control systems mean systems providing control of engines and propellers from the craft's control station.

.5 Back-up control systems mean systems necessary to maintain control of essential functions required for the craft's safe operation when the main control systems have failed or malfunctioned.

SECTION 3. SCOPE OF SUPERVISION

3.1 The following systems are subject to supervision during manufacture:

.1 WIG craft stabilization systems;

.2 control and protection systems of essential machinery and systems.

SECTION 4. TECHNICAL DOCUMENTATION

4.1 Before manufacture of individual automated systems and essential devices to be installed on WIG craft the documentation referred to in 1.4.1, Part XV "Automation" of Rules for the Classification and Construction of Sea-Going Ships is to be submitted to the Register for consideration and approval.

SECTION 5. STABILIZATION SYSTEMS

5.1 The stabilization system is to be designed so that, in case of failure or malfunctioning of any one of the stabilization devices or equipment (rudders, wings, keels, stabilizers), its power drive or control (automated) system, the remaining operable stabilization controls could either maintain craft's motion under safe conditions or put the craft safely to the displacement mode.

5.2 For the case of failure of the stabilization system an automatic safety control system is to be provided to put the craft to a safe mode. Where the automatic safety control system is used, provision is to be made to override it and to cancel an override from the main control position of WIG craft. Alarms on overriding the automatic safety control system, on a failure in its circuit, and on transfer to the back-up system or device are to be provided.

5.3 In case the limiting levels of the monitored parameters are exceeded, the automatic safety control system is to give a command to decrease the craft's speed and put the craft to a safe mode. Account is to be taken of the safe values of heel, trim, yaw and altitude. Consequences of failure in power supply to propulsion, lift or stabilization devices are also to be taken into consideration.

5.4 The stabilization system is to be supplied from two independent sources of power. The transfer from one source to the other is to be automatic and accompanied by an alarm.

SECTION 6. CRAFT'S CONTROL STATIONS

6.1 Navigator's workstations equipped with all controls, safety and protection systems, alarms and indication of parameters given in Table 6.1 are to be provided at all control stations.

6.2 In case of several control stations means of communication between them are to be provided. The transfer of control from one operating station to another is to be effected only from the main control station.

6.3 The craft's control station is to be equipped with:

.1 audible and visual alarms "Fire in the engine compartment", "Water in the engine compartment";

.2 a device for emergency shutdown of the main propulsion machinery.

Table 6.1

Nos.	Controlled parameter	Measuring point	Alarms for limiting values of parameters	Automatic protection	Indication at the main control station	Notes
1	**Main machinery**					
1.1	Lubricating oil pressure	At engine inlet	min	Shutdown	Continuous	
1.2	Lubricating oil temperature	At engine inlet	max	—	—	
1.3	Lubricating oil level	Lubricating oil tank	min	—	—	
1.4	Coolant temperature	At engine outlet	max	Load reduction	Continuous	
1.5	Coolant level	Expansion tank	min	—	—	
1.6	Oil fuel pressure	At engine inlet	min	—	Continuous	
1.7	Oil fuel level	In daily tank	min	—	Continuous	
1.8	Oil fuel leakage	From high pressure pipes	Oil fuel availability	—	—	For diesel engines
1.9	Exhaust gas temperature	At engine outlet	max	—	—	
1.10	Engine speed	—	max	Shutdown	Continuous	
1.11	Ventilation availability	Engine compartment	Stop	—	—	For petrol engines
2	**Craft's mains and controls**					
2.1	Voltage	Switchboard	min	—	Continuous	
2.2	Load	Switchboard	max	—	Continuous	
2.3	Loss of main source of power	Switchboard	Stop	—	—	
2.4	Insulation resistance	Switchboard	min	—	Continuous	
2.5	Emergency source of power	Switchboard	Start of accumulator battery	—	Continuous	
2.6	Rudder angle indicator	—	—	—	Continuous	
2.7	Flap position	—	—	—	Continuous	
2.8	Pylon position	—	—	—	Continuous	For tilt pylons
2.9	Propeller plane position indicator	—	—	—	Continuous	
2.10	Control air pressure	Air cylinder	min	—	Continuous	
2.11	Fluid level in hydraulic system	Tank	min	—	—	

PART XVI. LIFE-SAVING APPLIANCES, SIGNAL MEANS, RADIO EQUIPMENT AND NAVIGATIONAL EQUIPMENT

SECTION 1. GENERAL

1.1 Scope of application.

1.1.1 This Part of the Rules apply to WIG craft defined in Section 1, "General" of the Rules.

SECTION 2. LIFE-SAVING APPLIANCES

2.1 General.

2.1.1 A possibility of evacuation of passengers and crew into rescue ships or life-saving appliances is to be provided in the shortest time by means of one operation.

2.1.2 The time for evacuation of all passengers and crew, and the evacuation procedure are to be demonstrated on the first craft of the series.

2.1.3 Provision with life-saving appliances of WIG craft operating under unfavourable climatic conditions (low temperatures of the ambient air and water) is subject to special consideration by the Register.

2.1.4 Survival craft and life-saving appliances of WIG craft are to comply with the requirements of Part II "Life-Saving Appliances" of Rules for the Equipment of Sea-Going Ships.

2.2 Personal life-saving appliances.

2.2.1 A lifejacket is to be provided for every person on board WIG craft. Besides, one lifejacket suitable for children is to be provided or such greater number as may be required to provide a lifejacket for each child.

2.2.2 Lifejackets are to be placed so as to be readily accessible and their positions are to be clearly indicated.

2.2.3 Before proceeding WIG craft to a voyage passengers of the craft are to be instructed on a procedure of evacuation in case of emergency and a method to wearing a lifejacket is to be demonstrated.

SECTION 3. SIGNAL MEANS

3.1 General.

3.1.1 Unless stated otherwise in this Section, signal means of WIG craft are to comply with the requirements of Part III "Signal Means" of Rules for the Equipment of Sea-Going Ships imposed upon ships of similar length.

3.1.2 Where installation of signal lights or shapes having characteristics and positioned as required by this Section on WIG craft is impracticable, the craft is to be provided with lights or shapes which have characteristics and arrangement as close to the requirements of this Section as possible.

3.2 Provision of WIG craft with signal means.

3.2.1 The requirements for provision of WIG craft with signal shapes and radar reflectors are recommendations. Where WIG craft is not provided with these signal means WIG craft is to have other means capable to ensure the same safety level.

3.2.2 Provision of a bell in WIG craft 12 m in length and more is not compulsory.

3.2.3 A WIG craft is to be provided with an all-round flashing yellow light with characteristics indicated in item 9 of Table 3.1.9, Part III "Signal Means" of Rules for the Equipment of Sea-Going Ships.

3.2.4 WIG craft is to be provided with at least four red parachute rockets and four buoyant smoke signals. It is recommended that WIG craft be also provided with four red hand flares.

3.2.5 Provision is to be made for a portable signalling lamp capable of functioning independently of the craft's main source of electrical power.

3.2.6 WIG craft may not be provided with spare parts and materials.

3.3 Fitting of signal means.

3.3.1 A visual alarm is to be provided in the wheelhouse to warn failure of any lantern.

3.3.2 Where the all-round white light is fitted only as an anchor light and is not used as the masthead or stern light (for WIG craft under 12 m in length), this all-round white light may be detachable.

3.3.3 The portable signalling lamp is to be kept in the wheelhouse.

3.3.4 The yellow flashing light is to be placed so as to be visible all round the horizon and that there is no or minimum flashing light reflection from craft's structures which hinders observation of the situation around. It is to be fitted in a stationary position.

3.3.5 A special metal watertight locker or cabinet is to be provided in the vicinity of the wheelhouse for storing pyrotechnic signal means.

3.3.6 Signal shapes may be fitted manually using special fixing arrangements.

3.3.7 Where a radar reflector is fitted on WIG craft it is to comply with the requirements of 2.1.3, Part III "Signal Means" of Rules for the Equipment of Sea-Going Ships.

SECTION 4. RADIO EQUIPMENT

4.1 Scope of application.

4.1.1 This Section applies to WIG craft referred to in 1.1, "General" of the Rules, and to radio equipment intended for installation on board these craft.

4.1.2 As regards radio equipment of WIG craft not specified in this Section or specified partly, it is covered by the requirements of Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships, provided they are not in contradiction with the requirements of this Section.

4.2 Definitions and explanations.

4.2.1 Definitions and explanations relating to general terminology are given in Section 2 of "General" of the Rules and in Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships.

4.3 Scope of supervision.

4.3.1 All types of radio communication equipment required by this Section of the Rules, all devices relating thereto, independent sources of power, switchgear and cabling, as well as all spaces where the equipment is installed are subject to Register supervision during construction of the craft and in the course of its service.

4.3.2 Design and manufacture of all radio equipment required by this Section of the Rules and intended for installation on board WIG craft are subject to Register supervision.

4.3.3 The procedure for technical supervision is described in General Regulations for the Supervision and in Part I "Supervision Regulations" of Rules for the Equipment of Sea-Going Ships.

4.4 Technical documentation.

4.4.1 The requirements for the technical documentation on the radio equipment of WIG craft submitted to the Register for consideration and approval within the technical or working design are given in 3.1.5, Part I "Supervision Regulations", and those for design and manufacture of radio equipment in 1.3.4, Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships.

4.4.2 In addition to the documentation referred to in 4.4.1, a maintenance procedure according to 4.10 is to be indicated and information on sea navigation areas governing the choice of the radio equipment is to be presented.

4.5 Radio installations.

4.5.1 General.

WIG craft radio equipment, while on route, is to be capable of:

transmitting ship-to-shore distress alerts;

receiving shore-to-ship distress alerts;

transmitting and receiving ship-to-ship-distress alerts;

transmitting and receiving search and rescue co-ordinating communications;

transmitting and receiving on-scene communications;

transmitting and receiving signals at a frequency 9 GHz for locating of objects in distress;

receiving information on safety at sea.

4.5.2 All types of radio equipment required by this Section regarding technical characteristics are to comply with the relevant requirements of Sections 5 to 15, Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships.

4.6 Radio equipment composition.

4.6.1 Depending on the navigation area, each WIG craft is to be provided with radio equipment in accordance with Table 4.6.1.

4.7 Radio equipment arrangement.

4.7.1 All radio equipment required is to be arranged in a space from where the craft is operated, convenient for maintenance and provided with a small table or a sliding (hinged) board for making notes.

4.7.2 All control, tuning and indication devices of radio equipment are to be arranged so as to be readily accessible for an operator, while he is seated, and their location is not to interfere with WIG craft operation.

4.7.3 Radio equipment is to be so installed that it is readily accessible for shore-bases and at-sea maintenance.

4.7.4 Radio equipment is to be supplied with electrical power from the switchboard positioned in WIG craft control station.

4.7.5 An accumulator battery of the reserve source of radio equipment power supply, required by 4.8.1, is to be positioned at a level not lower than the deck where the radio equipment is installed; the length of cables is not to exceed 15 m.

Where the accumulator battery of the reserve source of radio equipment power supply is placed in a separate room or a box, their arrangement is to comply with the requirements of 3.3, Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships.

4.7.6 A radar transponder is to be installed in the control station compartment at a place from where it can be easily transferred to survival craft.

4.7.7 The two-way VHF radiotelephone apparatus and primary batteries are to be kept at a conspicuous place of the control station compartment, from where they can be easily transferred to survival craft. All securing and stowage arrangements of the two-way VHF radiotelephone apparatus and primary batteries are to be also installed in the craft's

Table 4.6.1

Nos.	Radio equipment	Sea area			
		A1	A2	A3	A4
1	A VHF radio installation [1]				
	DSC encoder	1	1	1	1
	DSC watch receiver	1	1	1	1
	radiotelephone station	1	1	1	1
2	MF radio installation [1, 2]				
	DSC encoder	—	1	—	—
	DSC watch receiver	—	1	—	—
	radiotelephone station	—	1	—	—
3	MF/HF radio installation [1]				
	DSC encoder	—	—	—	1
	DSC watch receiver	—	—	—	1
	telephone and NBDP receiver	—	—	—	1
	telephone, DSC and NBDP transmitter	—	—	—	1
	direct-printing apparatus of improved fidelity	—	—	—	1
	terminal printing device	—	—	—	1
4	INMARSAT ship earth station [2]	—	—	1	—
5	COSPAS-SARSAT satellite EPIRB	1	1	1	1
6	Craft's radar transponder	1	1	1	1
7	Two-way VHF radiotelephone apparatus	2	2	2	2
8	Command broadcast apparatus [3]	1	1	1	1
9	NAVTEX service receiver [4]	1	1	1	1
10	EGC receiver [5, 7]	1[6]	1[6]	1	—
11	HF direct-printing radiotelegraph receiver for reception of MSI	—	—	—	1[8,9]

[1] A combined installation or separate devices are allowed.
[2] Not required with MF/HF radio installation.
[3] For ships carrying passengers where control station is structurally separated from passenger compartment.
[4] Installation of the receiver is compulsory if the craft is engaged on voyages in an area where international NAVTEX service is provided.
[5] Not required in craft engaged in voyages in an area where international NAVTEX service is provided.
[6] Required in craft engaged in voyages in an area within coverage of an INMARSAT geostationary satellites but where international NAVTEX service is not provided.
[7] Allowed as part of INMARSAT ship earth station.
[8] Not required in craft engaged in voyages in an area where international NAVTEX service is provided.
[9] Allowed as part of MR/HF installation.
N o t e : The requirements of the above table apply to WIG craft engaged exclusively in voyages within one of sea areas: A1, A2, A3 or A4. In case a craft is engaged in voyages within two or more sea areas, the composition of radio equipment is subject to special consideration by the Register.

operating compartment. Provision is to be made for release of the two-way VHF radiotelephone apparatus and primary batteries from these arrangements without applying any tools.

4.8 Sources of power.

4.8.1 Supply of electrical power from the main source of power sufficient for operation of radio equipment referred to in Table 4.6.1 and charging of the reserve source of electrical power must be available at all times, while the craft is at sea. The requirements for the reserve source of electrical power are given in 2.3, Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships. The reserve source of electrical power is to be capable of simultaneously operating the radio installations and INMARSAT ship earth station required by this Section of the Rules as well as navigational equipment required by Section 5 " Navigational Equipment" for a period of at least 2 hours.

4.8.2 Where installation of the reserve source of electrical power is impracticable, the radio equipment, in case of failure of the main source of electrical power, is to be supplied from the emergency source of electrical power, provided the accumulator battery of the emergency source has an adequate capacity and is not used as a starter battery. Use of the emergency source of electrical power in lieu of the reserve source is subject to special consideration by the Register.

4.8.3 Electrical power from the switchboard is to be supplied to radio equipment by two independent outgoing feeders, using appropriate switching and protective equipment. Electrical energy to the switchboard busbars from the main and reserve or

emergency sources is to be supplied by two independent feeders.

4.9 Aerials.

4.9.1 Each WIG craft is to be provided with aerials necessary for operation of radio equipment in compliance with 2.4, Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships.

4.9.2 Lead-ins and interior wiring of the aerials are to comply with 4.7, and construction of the aerials and their arrangement are to meet the requirements of 4.1 to 4.6, Part IV "Radio Equipment" of Rules for the Equipment of Sea-Going Ships.

4.10 Maintenance.

4.10.1 Serviceability of radio equipment is to be ensured with shore-based maintenance and repair.

4.10.2 Provision is to be made in sea areas where WIG craft operate and on routes of passages for shore-based repair and maintenance of radio equipment; craft in service are to have a maintenance agreement for shore-based maintenance with the manufacturer of the equipment or with a company duly authorized by the manufacturer. Shore-based maintenance centres are to be recognized by the Register.

SECTION 5. NAVIGATIONAL EQUIPMENT

5.1 Scope of application.

5.1.1 This Section applies to WIG craft referred to in 1.1, "General" of the Rules and to navigational equipment intended for installation on these craft.

5.1.2 As regards navigational equipment of WIG craft not specified in this Section or specified partly, it is covered by the requirements of Part V "Navigational Equipment" of Rules for the Equipment of Sea-Going Ships, provided they are not in contradiction with the requirements of this Section.

5.2 Definitions and explanations.

5.2.1 Definitions and explanations relating to general terminology are given in Section 2, "General" of the Rules and in Part V "Navigational Equipment" of Rules for the Equipment of Sea-Going Ships.

5.3 Scope of supervision.

5.3.1 All types of navigational equipment required by this Section of the Rules, all devices relating thereto, independent sources of power, switchgear and cabling, as well as all spaces where the equipment is located are subject to Register supervision during construction of the craft and in the course of its service.

5.3.2 Design and manufacture of all navigational equipment intended for installation on WIG craft are subject to Register supervision.

5.3.3 The procedure of technical supervision is described in General Regulations for the Supervision and in Part I "Supervision Regulations" of Rules for the Equipment of Sea-Going Ships.

5.4 Technical documentation.

5.4.1 The requirements for the technical documentation on navigational equipment of WIG craft submitted to the Register for consideration and approval within the technical or working design are given in 3.1.6 , Part I "Supervision Regulations" and those for manufacture of radio equipment in 1.3.6, Part V "Navigational Equipment" of Rules for the Equipment of Sea-Going Ships.

5.5 Navigational equipment composition.

5.5.1 Navigational equipment composition is to meet the requirements of Table 5.6.1.

Table 5.5.1

No.	Navigational equipment	Q-ty	Notes
1	Magnetic or gyro- compass	1	
2	Radar	1	to operate within
3	Receiver for satellite global positioning system GPS/ GLONASS	1	3 cm range
4	Prismatic field glasses	1	

Navigational equipment composition may be changed on agreement with the Register.

5.6 Navigational equipment arrangement.

5.6.1 All navigational equipment is to be arranged at the place from where WIG craft is operated.

Where separate items of navigational equipment cannot be arranged in such places, their displays and controls are to be located in accordance with this requirement.

5.6.2 Displays and controls of navigational equipment are to be located so as to provide their convenient use by a personnel operating WIG craft. Personnel is not allowed to leave their seats.

5.6.3 The radar display is to be installed so that when WIG craft own heading is used for orientation, course mark it is to be located on the display along the centreline of the craft in the direction of the bow.

5.6.4 A radar installation is to be mounted so as to be as free as possible from vibration.

5.7 Sources of power.

5.7.1 All navigational equipment is to be supplied from the main source of electrical power.

In case of failure of the main source of electrical power, provision is to be made for navigational equipment power supply from the emergency source of electrical power referred to in 4.8.1 for at least two hours.

5.7.2 Where installation of the reserve source of electrical power is impracticable, navigational equipment, in case of failure of the main source of electrical power, is to be supplied from the emergency source of electrical power, provided the accumulator battery of the emergency source has an adequate capacity and is not used as a starter battery. The use of the emergency source of electrical power in lieu of the reserve source is subject to special consideration by the Register.

5.7.3 Each item of navigational equipment which require electrical power for its operation is to be supplied from the switchboard by independent feeders. Electrical power to the switchboard busbars from the main, reserve or emergency sources is to be supplied by two independent feeders.

5.7.4 Lighting of magnetic compass is to be provided from the craft's main and emergency sources of electrical power.

5.8 WIG craft control station.

5.8.1 In all idle and motion modes, as well as in all other circumstances when at sea a craft is to be operated from WIG craft control station.

5.8.2 Blind sectors in the operating station are to be as few as possible. The total arc of blind sectors from right ahead to 22,5° abaft the beam on either side is not to exceed 20°. Each individual blind sector is not to exceed 5°. The clear sector between two blind sectors is not to be less than 10°. The view of the sea surface from the control station for the officer in charge, when he is seated, is not to be obscured by more than one craft length forward of the bow to 90° on either side irrespective of the craft's draught and trim.

5.8.3 The number of workstations for personnel on watch in the control station compartment is to be sufficient for normal watchkeeping and operation of WIG craft. The number of workstations and their arrangement may vary depending on the operating crew and is subject to special consideration by the Register.

5.8.4 Each workstation for the operating crew members is to be provided with a seat and control panel with all necessary controls to enable the operating crew to perform all the required functions.

5.8.5 Seats are to be suitably adjusted and arranged so that the operating crew members are seated facing WIG craft bow. All controls are to be easily accessible for the occupants without a need to leave a seat. The height of the seats is to be such that, along with adequate view, all displays on the control desk, signal lights and other equipment can be easily seen.

5.8.6 Seats are to be provided with safety belts and secured in the position most comfortable for the operating crew members, which is not to be changed under operating conditions. The operating crew members are to be able to perform all operations necessary to operate the craft, except in respect of controls which are only required on very rare occasion and which are not associated with the need for safety restraint.

5.8.7 The size of the table is to be sufficient for chart work and records in the log-book by the operating crew members without leaving their seats. In case of suitable arrangement of radio and navigational equipment one table instead of that required by 4.7.1, Section 4 "Radio Equipment" may be installed; however, this is subject to special consideration by the Register.

5.8.8 Where provision is made on WIG craft for an automatic rudder control device to steer a steady course, the table for chart work may be positioned beyond the workstation but close thereto. In such case, it is allowed to the navigator to leave the seat temporarily.

5.8.9 Controls and instruments are to be of a dark colour, their lighting intensity is to be regulated to prevent glare. Where visual information is provided to more than one operating crew member, it is to be clearly viewed by all users concurrently. If this is not possible, the instrument or display is to be duplicated.

5.8.10 WIG craft control station is to be equipped with general and local lighting, heating and ventilation.

5.8.11 Instruments and devices installed in WIG craft control station are not to produce noise reducing audibility of sound alarms.

5.8.12 Where provision is made to operate the craft from workstations other than WIG craft control station, instruments and controls are to be switched over to operation from other workstations only from WIG craft control station.

5.8.13 Sockets supplied from the emergency source of electrical power for connection of a portable lamp which is to be permanently kept in WIG craft control station are to be provided in the control station.

5.8.14 Where WIG craft control station is equipped with a combined craft control desk, one must be guided by the provisions of this Section, those of 5.13, Part V "Navigational Equipment" of Rules for the Equipment of Sea-Going Ships and 4.5, Part XI "Electrical Equipment" of Rules for the Classification and Construction of Sea-Going Ships.

5.8.15 The number of divisions between windows is to be kept to a minimum. The divisions are not to be located immediately forward of control stations. The control station windows are to be so angled and their surface is to be curved so that no glare, reflections or distortions are produced, likely to result in navigation errors. Neither polarized or tinted window glass is to be fitted.

Windows are to be made of a material which will not break into dangerous fragments if fractured.

5.9 Operating requirements for navigational equipment.

5.9.1 All types of navigational equipment and devices required by this Section of the Rules, if it is not in contradiction with the requirements given below, are to comply (regarding their operating characteristics) with the requirements of 5.1, 5.2, Part V "Navigational Equipment" of Rules for the Equipment of Sea-Going Ships as well as with special requirements resulted from high speeds of WIG craft. Such requirements are subject to special consideration by the Register.

5.9.2 Radar installations.

5.9.2.1 The radar installation is to be capable of detecting a coastal line, above sea objects and locating their position. The radar is to be capable of continuous uninterrupted all round scanning of the horizon under true and relative motion presentation. All radars operating in 3 cm range are to have horizontally polarized radiation.

5.9.2.2 Where the radar aerial is installed at a height 7,5 m above the sea level, the radar display unit is to be capable to ensure clear presentation of above sea objects, such as navigation buoys with an effective dissipation area 10 m^2 at a distance 2,5 nautical miles with no interference. These objects are to be clearly seen at the radar display at a minimum distance to 35 m and up to a distance of one nautical mile.The above-mentioned requirements are to be met at rolling and pitching motions up to 10°.

5.9.2.3 The radar display is to have an effective diameter of at least 250 mm without any outside magnifying instruments. The display is to provide multi-colour presentation and regulation of its brightness. Provision is to be made for the quick change of colour presentation for better observation both in daytime and at night.

The display unit of the radar is to be provided with sets of range scales: 0,25; 0,5; 0,75; 1,5; 3; 6; 12 and 24 nautical miles. Provision may be made for additional range scales. There must be indicated not less than two fixed electronic range rings on range scales 0,25; 0,5 and 0,75, and up to six rings on the other scales.

The nominal value of the range scale and distance between fixed electronic range rings are to be clearly indicated on the working part of the display unit.

Besides, variable electronic marker range with a numeric read-out of the range is to be provided for each measuring range.

The fixed range rings and the variable range marker are to ensure the accuracy of measurement of the object range with an error not exceeding 1% of the maximum range of the scale in use, or 30 m, whichever is the greater.

Provision is to be made for off-set of the centre of scanning at least for 50% but not more than for 75% from the range scale used.

It is to be possible that brightness of the fixed electronic range rings and a variable electronic marker range are varied up to total removal from the display.

5.9.2.4 The display unit of the radar is to have an electronic direction sighting device intended for determination of the direction to any target which mark appears on the screen. The error of measurement of the direction to a target which is on the edge of the screen is not to exceed $\pm 1°$.

Provision is to be made for at least two lines of the direction sighting device.

After installation on board the craft and adjustment the accuracy of measurement of the direction to the target is to be maintained without any adjustments independently of the craft's movement in magnetic fields of the Earth.

5.9.2.5 The craft's heading is to be indicated on the screen by means of electronic course mark in the form of a line with a maximum error $\pm 1°$. The width of the course mark at the edge of the display face is not to exceed 0,5°.

The possibility is to be provided for temporary removal of the course mark image using a switch with automatic reset to "on" position.

5.9.2.6 Provision is to be made for indication on the screen of the display unit, along with radar information, of the planned route in graphical form, i.e. route points and segments of straight lines connecting them. The source of graphical information is to be clearly indicated.

The possibility is to be provided for displaying target motion trajectories in the form of trails created by the marks of the targets due to the screen artificial afterglow.

The trails are to be relative or true, the true trails are to be stabilized relative to the water or ground.

5.9.2.7 The radar is to have a resolution that, in case of no interference, provides:

.1 on 1 mile range scale and less, separate indication of two objects with an effective target area 10 m^2 located on the same azimuth at the distance equal to 50 — 100% of the range nominal value of the range scale used and distant not more than 35 metres from each other;

.2 on 1,5 mile range scale and less, separate indication of two objects with an effective target area 10 m^2 located at the same distance within 0,5 to 1 mile limits and not more than 2,5° from each other from radars operating in 3 cm range and not more than 4° for radars operating in 10 cm range.

5.9.2.8 Devices are to be provided to eliminate interference created by reflections from precipitation, clouds, sand storms and sea surface.

Provision is to be made for smooth manual regulation of such devices and for switching off those signal processing devices which may prevent reflection from the radar beacon responder.

5.9.2.9 The radar is to be ready for operation within 4 minutes upon being switched on. The "stand-by" position is to be provided after which the radar may be set in the "switched on" position within 15 s.

5.9.2.10 Means are to be provided to check and determine a substantial drop in performance relative to the manufacturer's calibration standard and to check that the equipment is correctly adjusted in the absence of targets.

5.9.2.11 The radar is to be capable of receiving information signals from the gyrocompass, log, receivers of radionavigation systems. Alarms on absence or degradation of quality of information signals from the above equipment are to be duplicated.

5.9.2.12 The radar is to be capable to provide all-round view over the entire horizon in the relative motion mode. The accuracy of alignment with a course information source is to be within $\pm 0{,}5^\circ$ with a rotation rate 20°/s.

The radar is to properly operate in the absence of a signal from a course information source.

It is recommended to provide the possibility of radar operation in the true motion mode.

5.9.2.13 Provision is to be made in the radar for clockwise continuous and automatic scan through 360° of azimuth. The scan rate is to be not less than 40 rpm.

The aerial is to be capable to operate with a relative wind velocity up to 100 knots.

5.9.2.14 Controls are to be readily accessible and easily recognizable.

In case symbols are used for their indication, they are to correspond to commonly used symbols for identification of navigation marine radar controls. A navigator has to switch on and operate the radar, when seated.

5.9.3 Gyrocompasses.

5.9.3.1 The gyrocompass positioned on a horizontal and stationary base on board the craft operating in latitudes of up to 70° is to comply with the following requirements:

.1 the gyrocompass is to be brought into alignment with meridian within 6 hours;

.2 the steady-state error at any course is not to exceed $\pm 0{,}75^\circ$ secant latitude, the gyrocompass course is taken as the arithmetical mean of ten readings taken every 20 minutes, and the root mean square value of the differences between individual course indications and the mean value is to be not less than $\pm 0{,}25^\circ$ secant latitude;

.3 the permissible error from one run-up to another is to be within $\pm 0{,}25^\circ$ secant latitude.

5.9.3.2 The gyrocompass mounted on WIG craft operating in latitudes up to 70° is to comply with the following requirements:

.1 under rolling and pitching harmonic motions with a period of 6 to 15 s, amplitude of 5° at maximum accelerations of 22 m/s^2 the gyrocompass is to be brought into alignment with meridian within 6 hours;

.2 the steady-state error of the master compass readings under service conditions with due regard to variations of the magnetic field, temperature and craft's mains is to be within $\pm 1^\circ$ secant latitude;

.3 the maximum divergence in readings between the master compass and repeaters is not to exceed $\pm 0{,}5^\circ$ under any operational conditions;

.4 the respond rate of the gyrocompass follow-up system is to be not less than 20°/s.

5.9.3.3 In latitudes up to 70°, when the craft operates within the latitude range 10°, the gyrocompass is to comply with the following requirements:

.1 the residual error at a straight course (after correction for speed and course at a speed of 70 knots is not to exceed $\pm 0{,}25^\circ$ secant latitude;

.2 the maximum error of readings because of a rapid alteration of ship's speed for 70 knots is not to exceed $\pm 2^\circ$;

.3 the error of readings because of rapid alteration of course of 180° at a turn angular speed 20°/s and speed 70 knots is not to exceed $\pm 3^\circ$;

.4 the error of readings because of rolling up to 20°, pitching up to 10° and yawing up to 5° with a period from 6 to 15 seconds and the maximum horizontal accelerations not more than 1 m/s^2 at any course (in particular, 45°, 90° and 315°) is not to exceed $\pm 1^\circ$ secant latitude.

5.9.3.4 Gyrocompass is to be provided with a compass card or analogue repeater for WIG craft control, visual bearing taking devices as well as a corrector used for correction of compass readings in respect of craft's speed and latitude.

The device is to be calibrated in 1 or 1/10 increments. Digital markings are to be indicated in every 10° clockwise from 0° to 360°.

In addition a digital indicator may be provided. The course is to be presented on the digital indicator in three figures (the fourth may indicate tenths of a degree).

5.9.3.5 The remote indication system of the gyrocompass is to be designed so as to ensure simultaneous operation of gyrocompass own repeaters, course recorders, as well as repeaters fitted in other navigational equipment.

5.9.3.6 A course recorder is to be capable of recording craft's course in respect of time with an accuracy $\pm 1\%$.

5.9.3.7 Provision is to be made for a signal indicating gyrocompass readiness, as well as an alarm on power supply failure or failures in the compass system.

APPENDIX

TYPICAL INSTRUCTIONS ON SAFETY OF TYPE A WIG CRAFT IN SERVICE

1. GENERAL

1.1 Scope of application.

1.1.1 These Instructions on Provision of Safety of Category A WIG craft[1] in service are mandatory for all shipowners operating WIG craft engaged in carriage of passengers and covered by the Rules.

1.2 Definitions.

1.2.1 Place of refuge is any naturally or artificially sheltered aquatorium which may be used as a shelter by WIG craft under conditions likely to endanger its safety. Facilities for communication with the base port and means for transportation of passengers or cargoes are to be provided in this aquatorium .

1.2.2 Base port is a port which is provided with:

access to facilities provided with appropriate rescue and survival equipment;

access to craft maintenance services with appropriate equipment and personnel.

1.2.3 Terminal is a port from where WIG craft commences or where it terminates a voyage. Terminal may be used for WIG craft stay between voyages.

1.2.4 Intermediate ports or port points are points which are located between terminals and which are called by WIG craft according to the schedule in the course of operation.

2. PROVISION OF WIG CRAFT SAFETY IN SERVICE

2.1 The necessary level of WIG craft safety in service is ensured by complex fulfilment of rule requirements and arrangements by a shipowner in compliance with these Instructions.

2.2 A shipowner has to:

2.2.1 operate WIG craft meeting the conditions on which the Register documents have been issued;

2.2.2 obtain a weather forecast for the entire region of WIG craft operation at intervals sufficient for WIG craft to take shelter in the places of refuge under unfavourable weather conditions;

2.2.3 to maintain continuous reliable radio communications directly or via intermediate radio centres with every WIG craft while on route and in ports;

2.2.4 to have facilities for rendering assistance to WIG craft in distress and to use, if necessary, these facilities which are to be maintained in permanent readiness;

2.2.5 to have a base port in the region of WIG craft operation.

In case no access to facilities and services referred to in 1.2.2 of these Instructions is available in the base port, a shipowner may use such facilities and services owned by other organizations located in the region of WIG craft operation. A possibility to use such facilities and services is to be properly documented;

2.2.6 to allow WIG craft to go to sea with full complement of the crew specially trained to operate WIG craft of the particular type;

2.2.7 to check periodically knowledge of the crew and to conduct regular drills under normal and emergency conditions;

2.2.8 to provide for rest of WIG craft crew between voyages;

2.2.9 to control WIG craft motion, including arrival of WIG craft in intermediate and terminal ports;

2.2.10 to have the necessary safety means on berths;

2.2.11 to equip properly WIG craft and their routes and safely operate WIG craft in restricted visibility or by night, as appropriate;

2.2.12 to carry out maintenance, preventive inspections, including those referred to in the Rules, and repairs of WIG craft;

2.2.13 to have manuals on operation, maintenance, preventive inspections and repairs of WIG craft, as well as a system to control over the fulfilment of the instructions by WIG craft crews and shore-based personnel;

2.2.14 to maintain WIG craft log-books where all incidents connected with WIG craft operation, malfunctions of machinery, arrangements and equipment subject to the Register supervision and all cases of the loss of stability are recorded. Shipowners are to report all failures and malfunctions which could jeopardize passengers, crew and WIG craft to the Register Inspectorate supervising operation of the WIG craft. Dates and results of the inspections to be carried out by a shipowner in compliance with the Rules are to be indicated in the log-books;

2.2.15 to check the effect of repeated short-term operation of instruments and machinery installed on WIG craft on the main magnetic compass and to

[1] Hereinafter referred to as "WIG craft".

introduce the relevant corrections in the deviation tables.

2.3 Operational control over the fulfilment of arrangements and requirements referred to in this Appendix is to be effected by a department of the shipowner's company, specially assigned for these functions.

3. OPERATION RULES

3.1 In addition to these requirements and the Rules requirements, one must be guided in operation of WIG craft by appropriate merchant marine documents in force, such as manuals, regulations, guidelines, directions.

4. CONFIRMATION OF OPERATOR'S READINESS TO OPERATE WIG CRAFT[1]

4.1 Procedure for the Confirmation issuance.

4.1.1 The Confirmation is presented to the Register, provided the provisions of 2.2 of the Instructions are fulfilled.

4.1.2 The Confirmation is issued by a shipowner for a period of one year for the certain route or region, having regard for using particular WIG craft on that route or in that region.

[1] Hereinafter referred to as "the Confirmation"

4.2 Sample of Confirmation.

CONFIRMATION OF SHIPOWNER'S READINESS TO OPERATE WIG CRAFT

_____ _____

(date) (place)

1. The Confirmation has been issued _____

(shipowner)

to the effect that operation of WIG craft _____

(name of WIG craft)

_____

operating on the route(s) _____

is ensured by fulfilment of the whole complex of organizational, technical and operational arrangements:

1.1 The system of control over WIG craft operation under conditions for which the Register documents have been issued.

1.2 Facilities to provide quick assistance to WIG craft in distress, namely:

_____

1.3 Provision of the base port and places of refuge in the region of WIG craft operation, namely:

_____

1.4 Provision of full complement of the crew specially trained to operate WIG craft of the particular type, namely:

_____

1.5 Organization of periodic checks of crew's knowledge and performance of regular drills to acquire skills necessary in WIG craft operation and emergency situations, namely:

_____

1.6 Organization of crew's work to prevent fatigue, namely:

_____

1.7 Control of WIG craft motion, including arrival of WIG craft in intermediate and terminal ports, namely:

_____

1.8 Safety means on berths, namely: _____

1.9 Provision of equipment required for WIG craft operation in restricted visibility, as well as organization of WIG craft motion under such conditions, namely:

_____

1.10 Organization of WIG craft maintenance, servicing, preventive inspections and repairs, namely:

_____

1.11 Availability to crews and shore-based personnel of manuals on operation, maintenance, servicing, preventive inspections and repairs of WIG craft, and organization of system to control over the fulfilment of the instructions, namely: _____

_____

1.12 Provision on WIG craft of special log-books where all incidents of WIG craft, malfunctions of machinery, arrangements and equipment subject to the Register supervision, as well as all cases of WIG craft stability loss are recorded, namely: _____

_____

2. The shipowner undertakes to fulfil the above-mentioned complex of arrangements aiming to ensure WIG craft safe operation.

3. The Confirmation is valid until _____
provided it will not be suspended or cancelled.

Signature of duly authorized person _____
(shipowner, captain of port,etc)

L.S.

5. REQUIREMENTS FOR BASE PORT RESCUE AND SALVAGE FACILITIES

5.1 A rescue and salvage facility (ship, helicopter, etc) is a means intended for salvage of passengers, crews and WIG craft in distress, which can be effectively used by the shipowner for these purposes.

5.2 The salvage facility is to be capable to maintain radio communications with the WIG craft in distress and with its survival craft fitted with a portable radio station when they sail independently of the WIG craft.

5.3 Spaces to accommodate people in distress and to render first aid to them are to be provided on the salvage facility.

5.4 Salvage facilities and their location relative to the region of WIG craft operation are to be such that assistanceto WIG craft in distress , if required, can be rendered within three hours.

5.5 Salvage facilities which can be used by the shipowner are to have such qualities and to be provided with such equipment that assistance can be rendered under weather conditions worse than those under which WIG craft operation is allowed.

6. REQUIREMENTS FOR QUALIFICATION AND HEALTH OF CREW MEMBERS. INTERVALS BETWEEN CHECKS OF CREW KNOWLEDGE AND HEALTH EXAMINATIONS

6.1 The requirements for qualification and health of crew members and intervals between checks and examinations are to comply with current Regulations for Service on Board Sea-Going Ships and Regulations for Checking Knowledge of Sea-Going Ship Personnel.

6.2 An appropriate certificate is issued to crew members after checking of their knowledge and skills on steering and servicing of WIG craft on the particular route.

7. LIST OF DRILLS CONDUCTED BY CREW AND REQUIREMENTS FOR THE DRILLS

7.1 Muster lists are to be posted in conspicuous places on board every WIG craft, the station to which each member must go, and the duties that he has to perform are to be indicated.

7.2 Each crew member of WIG craft is to participate in the following drills:

fire extinction;

damage control;

survival craft use;

evacuation of passengers in emergency conditions;

"man overboard".

The purpose of the drills is to train each crew member in acquiring skills, to practise interaction between crew members in emergency situations.

8. LIST OF MANUALS TO BE SUPPLIED TO WIG CRAFT AND SHIPOWNER'S PERSONNEL, AND REQUIREMENTS FOR THE MANUALS[1]

8.1 WIG craft operational manual which is to contain at least the following information:

8.1.1 particulars of WIG craft defining its operational qualities and possibilities, including:

8.1.1.1 permissible loading conditions, including maximum weight of WIG craft, centre of gravity position and recommended distribution of passengers and cargo;

8.1.1.2 safe maximum speed on land, in water and at various sea heights;

8.1.1.3 parameters of the worst intended and critical design conditions for appropriate modes of WIG craft motion (wind force,m/s, wave height, m, with 3% probability of exceeding level, ambient air temperature, visibility, etc);

8.1.1.4 allowable rudder and other steering control angles, allowable yaw and drift angles in all modes;

8.1.1.5 characteristics of WIG craft stability, upon exceeding of which transition of WIG craft to the displacement or other mode is required;

8.1.1.6 clearance of the lowest point of WIG craft hard structure above a hard flat surface in the amphibian mode;

8.1.1.7 characteristics of the relief where WIG craft can move in the amphibian mode (ground slopes for different courses, steps or discontinuities of the relief which the WIG craft can surmount, etc);

8.1.1.8 the maximum allowable towing speed;

8.1.2 recommendations on steering of WIG craft in the displacement mode under the worst intended conditions (recommended speeds, rudder angles, establishing continuous communication with the base port, selection of the nearest port, checking of closing appliances, bilge system, emergency call for assistance from the nearest port, etc);

8.1.3 the order of master's actions and duties of the crew in speeding-up of WIG craft for the ground effect mode, as well as for WIG craft stopping, including those under emergency conditions. The allowable period of time for WIG craft motion in the take-off/landing mode is to be indicated;

8.1.4 description of WIG craft behaviour during transition from one type of operating surface to another (e.g., from water to land and vice versa) and recommendations on WIG craft control under such conditions;

8.1.5 assessment of the effect of probable failures in the main machinery installation, propellers and their control systems, as well as probable failures in operation of the WIG craft stabilization system and controls, steering system and controls.

8.2 WIG craft maintenance and servicing manual which is to contain as a minimum:

8.2.1 list of inspections before every voyage and inspections performed at regular intervals with indication of their frequency;

8.2.2 list of servicing types and methods used;

8.2.3 list and frequency of emergency systems tests.

8.3 Engine operation manual which is to contain as a minimum:

8.3.1 power output of the engines in different modes (maximum, nominal, continuous);

8.3.2 service hours in these modes;

8.3.3 oil fuel consumption in these modes;

8.3.4 revolutions in these modes;

8.3.5 grade and type of oil fuel;

8.3.6 list of inspections and routine operations before every voyage and depending on actual working hours of the engines.

8.4 WIG craft loading manual which is to contain instructions on the type and quantity of cargo, its distribution on board to ensure WIG craft stability.

8.5 Maintenance and servicing manual for auxiliary systems, machinery, arrangements is to contain information on types and frequencies of inspections and service lives of components where their service life is less than that of WIG craft itself.

8.6 Operating manual for hydraulic systems which is to contain information on the hydraulic system, type and frequency of inspections, grade and type of hydraulic fluid.

8.7 Operating and maintenance manual for automation systems, including WIG craft automatic stabilization systems.

8.8 Maintenance manual for cathodic protection system which is to contain information on the types and frequency of inspections.

8.9 Fire safety and fire extinction manual which is to contain:

8.9.1 list of arrangements to ensure fire safety, including instructions that in case of fire detection and after putting fire fighting means into operation

[1] List and contents of manuals are to be updated by the designer and shipowner if required.

the master must inform the base port accordingly and begin, if necessary, evacuation of passengers into survival craft;

8.9.2 list of persons responsible for fire safety;

8.9.3 procedure for evacuation of passengers into survival craft in case of fire with regard to recommendations given on the basis of demonstration evacuation of passengers on the first craft of the series;

8.9.4 actions of the crew to extinguish the fire.

8.10 Emergency instructions which are to be obvious and brief, to contain instructions to be used by passengers in emergency situation and to be placed near each passenger seat.

8.11 Instructions on evacuation of passengers and use of survival craft. The evacuation scheme approved by the Register is to be displayed in a conspicuous place on WIG craft.

8.12 Instructions for crew on conducting fire extinguishing and passenger evacuation drills which are to contain directions on the procedure of conducting drills, duties of each crew member, frequency of the drills and persons responsible for conducting the drills.

8.13 Manual for lifting WIG craft on the shore which is to contain instructions on the procedure of WIG craft lifting on the shore, safety precautions, distribution of functions between the crew and shore personnel, persons responsible for lifting of WIG craft on the shore.

8.14 Instructions on emergency refloating by a floating crane or by pulling.

8.15 Instructions on checking buoyancy compartments integrity.

9. OPERATING AND TECHNICAL DOCUMENTATION TO BE KEPT ON BOARD WIG CRAFT OR BY SHIPOWNER AND REQUIREMENTS FOR THE DOCUMENTATION

9.1 Final and recording documentation (logsbooks, certificates, reports or equivalent documents) is to contain information on WIG craft operation (hull, machinery, arrangements, systems, etc) and technical condition (types of repairs, registration and control of alterations, etc), as well as failures, malfunctions, defects and faults.

List and form of the documentation are to meet the existing requirements.

9.2 Technical documentation:

9.2.1 General documentation:

.1 specification;

.2 general arrangement plans.

9.2.2 Hull documentation:

.1 drawings of longitudinal and transverse bulkheads.

9.2.3 Documentation on arrangements, equipment and outfit:

.1 arrangement plan of hull openings with indication of closing appliances;

.2 general arrangement plan for steering gear, anchor, mooring and towing arrangements.

9.2.4 Arrangement plans for signal means and survival craft.

9.2.5 Stability documentation:

.1 information on stability and subdivision for master and loading manual approved by the Register;

.2 lines drawing;

.3 hydrostatic curves;

.4 curves of areas and static moments of hull cross-sections;

.5 capacity curves.

9.2.6 Electrical and automation equipment documentation:

.1 circuit diagrams of the main, emergency and group switchboards with indication of connected consumers and electrical protection devices;

.2 circuit diagrams of electrical drives for essential machinery and devices;

.3 general arrangement plans of electrical equipment;

.4 cable run drawings with indication of sealings;

.5 list of monitored parameters, and alarm and warning systems;

.6 drawings of automation systems for essential machinery, including circuit schemes of electrical energy supply.

10. INSPECTIONS, CHECKS, MAINTENANCE

10.1 WIG craft is to be maintained in working order by means of inspections, checks, maintenance and other arrangements. The purpose of such arrangements is detection and timely elimination of defects (cracks, water leaks, collection of dust, moisture, change of lubricants or hydraulic fluid, replacement of worn-out machinery, assemblies, components, parts, devices or of those service life of which has expired).

10.2 The procedure for preventive measures (scope and approximate route; checking operations, including test start, tests, frequency) is to be established by the shipowner in compliance with the operating manuals compiled by the designer. The crew and shore repair teams have to participate in the above-mentioned works.

11. OPERATIONAL REQUIREMENTS

11.1 All ports for receiving WIG craft are to be suitable for their mooring, passenger and/or cargo handling operations (embarkation and disembarkation of passengers, loading and discharging of cargoes) or are to be provided with places for going ashore and sites for mooring.

11.2 The base port is to be located in the vicinity of the region of WIG craft operation.

In addition to the provisions of 1.2.2 of the Instructions, the base port is to have facilities for lifting of WIG craft, as well as the equipment for routine repairs and maintenance and (desirably) facilities for WIG craft towing or carriage on board a displacement ship for driving from one place to another or for repairs.

11.3 Terminals and port points are to be equipped in accordance with 11.1, as well as for WIG craft stays between voyages (e.g., at night time), with electrical power, watchkeeping services and to have spaces ashore for rest of crews, cooking and eating.

Arrangements are to be made for conducting routine preventive operations and, if necessary, replenishment of oil fuel, lubricating oil and potable water stores.

11.4 Intermediate ports and port points are to be equipped in compliance with 11.1.

11.5 At least one port in the region of WIG craft operation is to have ashore (or on board special ship) facilities for receiving various wastes and garbage from WIG craft in accordance with MARPOL 73/78 requirements.

11.6 Where WIG craft operate on long routes, intermediate fuelling points with oil fuel and lubricating oil stores, as well as facilities and equipment for WIG craft maintenance and servicing are to be available.

11.7 The technique of WIG craft repair is to be agreed with the Register.