GUIDANCE NOTES
GD 11-2021

CHINA CLASSIFICATION SOCIETY

GUIDELINES FOR SURVEY OF SELF PROPELLED HYPERBARIC LIFEBOATS FOR SATURATION DIVING SYSTEM

2021

Effective from June 1, 2021

Beijing

CONTENTS

1 Application

1.1 The Guidelines apply to the approval and survey of self-propelled hyperbaric lifeboats provided for saturation diving systems.

2 Normative references

2.1 The approval and survey of self-propelled hyperbaric lifeboats are based on:

(1) CCS Rules for Construction and Classification of Diving Systems and Submersibles;

(2) CCS Rules for Classification of Sea-Going Steel Ships;

(3) CCS Rules for Materials and Welding;

(4) IMO International Life-Saving Appliance (LSA) Code (MSC.47 (66) and its amendments);

(5) IMO Code of Safety for Diving Systems (A.536 (13) and its amendments);

(6) IMO Revised Recommendation on Testing of Life-Saving Appliances (MSC.81 (70) and its amendments);

(7) IMO Guidelines and Specifications for Hyperbaric Evacuation Systems (A.692 (17)).

3 Definitions

3.1 Self-propelled hyperbaric lifeboat is a life boat carrying crew member with autonomous navigation capability at sea. The boat carries a hyperbaric escape chamber which may accommodate specified number of divers and be provided with life support system and living facilities, and is installed on the attendant ship and may be delivered and recovered by release and recovery device (hereinafter referred to as hyperbaric lifeboat).

3.2 Hyperbaric escape chamber is a chamber enclosed by pressure hulls used to accommodate and transfer divers and other personnel under high pressure and normally provided with device for control of pressure difference inside and outside the chamber.

3.3 Hyperbaric evacuation system is the whole plant and equipment necessary for safe transfer of divers under high pressure from saturation diving system to a place where decompression may be carried out.

3.4 Life support system is an integration of systems of gas storage, gas supply, removal of harmful gases, environmental conditioning and control, emergency life support and living facilities required to provide a safe environment for occupants in the hyperbaric lifeboat.

3.5 Handling system is the plant and equipment necessary for release and recovery of hyperbaric lifeboat.

4 Plans and documents

The following plans and technical documents are to be submitted to CCS:

4.1 General and structure

(1) Technical specifications;

(2) General arrangement;

(3) General plan of hyperbaric escape chamber;

(4) Arrangement plan of hyperbaric escape chamber;

(5) Welding diagram of hyperbaric escape chamber;

(6) Plans of major components and parts;

(7) Handling diagram of hyperbaric escape chamber;

(8) Strength calculations of hyperbaric escape chamber;

(9) Structural plan of hyperbaric lifeboat (including transverse section plan, layout plan);

(10) Arrangement plan of buoyancy materials;

(11) Volume calculations of buoyancy materials;

(12) Hydrostatic curve graph;

(13) Lines plan；

(14) Stability calculations (including light load, full load, free flooding, inverted floating stability);

(15) Hull structural strength calculations of boat;

(16) Release device and its arrangement;

(17) Steering gear and its arrangement;

(18) Equipment list;

(19) Seat arrangement;

(20) Arrangement plan of windows and openings;

(21) Arrangement plan of engine, shafting and propeller;

(22) Head line release device and its arrangement plan;
(23) Arrangement plan of gas supply system;
(24) Arrangement plan of sprinkler system;
(25) Forming process documents;
(26) List of main materials;
(27) Operation and maintenance manual.

4.2 Machinery

(1) Schematic diagrams;
(2) Specifications of materials;
(3) Piping calculations;
(4) Equipment details;
(5) Specifications of life support system;
(6) Schematic diagrams of life support system;
(7) Arrangement plan of life support system;
(8) Piping and capacity calculations of breathing, oxygen system and carbon dioxide removal system.

4.3 Electrical installations

(1) Specifications of electrical installations;
(2) General arrangement plan;
(3) Panel arrangement plan;
(4) Technical specifications;
(5) Electrical schematic diagrams, including details of specifications of associated electrical appliances;
(6) Diagrams of power systems or single line diagram;
(7) Electrical Load Calculations and/or battery capacity calculations;
(8) Single line diagram and control schematic diagram (if applicable) of electrical propulsion machinery;
(9) Schematic diagrams of major systems (life support, communications, navigation, fire detection, illumination etc.);
(10) Arrangement plan of major electrical equipment;
(11) Details of electrical equipment;
(12) External wiring diagram (if applicable).

4.4 Fire fighting system

(1) Specifications of fire-fighting system;
(2) Arrangement plan of fire protection, detection and extinction equipment

4.5 Additional plans and documents may be required where considered necessary by CCS.

5 Raw materials and parts

5.1 Raw materials and parts of products are to comply with relevant requirements of the existing CCS rules.

5.2 Special materials, parts or products of hyperbaric lifeboat not covered by the existing CCS rules are to be agreed by CCS before being used.

6 Approval of procedures and test equipment

6.1 The approval of procedures required for manufacturing of hyperbaric lifeboat is to comply with the relevant requirements of the existing CCS rules.

6.2 Instruments for measurement and test are to be within valid calibration date. Gas concentration measurement instrument is to be calibrated with standard gas at test field.

7 Technical requirement for design

7.1 Hyperbaric lifeboat

7.1.1 General requirements

7.1.1.1 Unless otherwise stated in 7.1.2, the manufacturing materials, structural strength and machinery of hyperbaric lifeboat are to comply with the requirements for totally enclosed fire-protected lifeboats in LSA Code and Recommendation on Testing of Life-Saving Appliances.

7.1.1.2 Hyperbaric lifeboat is also to comply with the applicable requirements for self-propelled hyperbaric lifeboats in Guidelines and Specifications for Hyperbaric Evacuation Systems.

7.1.1.3 Hyperbaric lifeboat is to be type approved according to the requirements for lifeboats (L-06) in CCS Guidelines for Survey of Marine Products and issued with product certificate.

7.1.2 Special requirements

7.1.2.1 The total time from giving the evacuation order to transferring the diver to the hyperbaric lifeboat and being ready for release is not to exceed 15 minutes.

7.1.2.2 The total time from giving the release order to the hyperbaric lifeboat navigating on the water to 100 m away from attendant ship is not to exceed 30 minutes.

7.1.2.3 Each crew member on the hyperbaric lifeboat is to be provided with a lifejacket/ immersion suit.

7.1.2.4 Sufficient food and drinking water are to be provided onboard hyperbaric lifeboat to satisfy the living needs of all occupants in the boat for at least 72 hours.

7.1.2.5 The internal diameter of personnel access hatches for hyperbaric escape chamber is generally not to be less than 600 mm.

7.2 Pressure hull

7.2.1 Design

7.2.1.1 The pressure vessels withstanding an internal pressure are to comply with the relevant provisions of Chapter 4 of CCS Rules for Construction and Classification of Diving Systems and Submersibles and Chapter 6, PART THREE of CCS Rules for Classification of Sea-Going Steel Ships.

7.2.1.2 The maximum operating pressure is determined according to the maximum operating depth.

7.2.2 Materials

7.2.2.1 Steels, steel castings, steel forgings, steel pipes, etc., used for pressure hull are to be used in accordance with the requirements of PART ONE of CCS Rules for Materials and Welding and Section 2, Chapter 6 of Rules for Construction and Classification of Diving Systems and Submersibles.

7.2.2.2 Materials other than those specified in the rules may be accepted according to the recognized standards with the agreement of CCS.

7.2.3 Manufacture and process

7.2.3.1 The production and manufacture of the welded pressure vessels are to be carried out by the qualified manufacturer after the agreement by CCS.

7.2.3.2 The manufacture of pressure hull is to comply with the requirements of Section 2, Chapter 7 of Rules for Construction and Classification of Diving Systems and Submersibles.

7.2.3.3 Prior to the manufacture of the first pressure hull or the use of a new welding procedure, a welding procedure approval test is to be carried out according to Chapter 3, PART THREE of CCS Rules for Materials and Welding. Four sets (three specimens for each set) of impact test specimens are to be prepared, and the notches of specimens are to be positioned at the center of the weld, at the fusion line, at 2 mm from the fusion line and at 5 mm from the fusion line, respectively.

7.2.3.4 Prior to the manufacture of pressure hull, manufacturers are to submit welding procedure specifications to CCS for examination. In addition to the requirements of Sections 3, 4 of Chapter 7 of Rules for Construction and Classification of Diving Systems and Submersibles, the welding procedure specifications are to comply with relevant provisions of PART THREE of CCS Rules for Materials and Welding. The welders engaged in welding is to be certified with Qualification Certificate for Welders issued or approved by CCS and is only allowed to engage in the welding work consistent with the qualified category.

7.2.4 Survey and test

7.2.4.1 Internal pressure test is to be carried out for pressure hull withstanding internal pressure upon satisfactory NDT testing and other tests. For pressure hull with watertight plug-in unit, the internal pressure test is to be carried out after the plug-in unit is installed. For pressure hull to be heat treated, the internal pressure test is to be carried out after heat treatment. The test pressure is 1.5 times design pressure and is to be kept at least for 20 minutes. After the test, there is no leakage on the metal wall of pressure element or welds and no abnormal sound or visible residual deformation is found.

7.3 Stability and buoyancy

7.3.1 Hyperbaric lifeboats are to have sufficient stability and to be self-righting. Consideration is to be given to the effect of large righting moments on divers. Consideration is also to be given to

the effect equipment and rescue personnel, required to be placed on the top of the system to carry out a recovery from the sea, may have on the stability of the unit.

7.3.2 Hyperbaric escape chambers are to have sufficient reserve buoyancy so as to carry necessary rescue personnel and equipment.

7.3.3 Towing attachment point is to be so situated that there is no likelihood of the evacuation unit being capsized due to towage. Where towing harnesses are provided, they are to be lightly clipped or secured to the boat and, as far as is possible, be free from being hooked. Connection point is to be provided on the boat to secure it on the rescue boat.

7.4 Life support system

7.4.1 Means are to be provided to maintain all the occupants in the hyperbaric lifeboat in thermal balance and in a safe and breathable atmosphere for all environmental conditions envisaged and with the maximum and minimum number of divers likely to be carried. In determining necessary duration and amount of life support, consideration is to be given to the geographical and environmental conditions, oxygen and gas consumption and CO_2 generation under such conditions. Gas losses as a result of using toilet facilities which discharge to outside the hyperbaric lifeboat and lock operation are to be taken into account in determining the amount of gases required. The effects of hypothermia are to be considered and the effectiveness of the arrangements provided is to be established as far as is reasonable and practicable under all conditions envisaged. However in no such case is the duration of the unit's autonomous life-support endurance to be less than 72 hours.

7.4.2 When the hyperbaric lifeboat is in standby condition, a saturation diving system on board an attendant ship or an offshore unit may be used for compression, pressure maintaining and air change provided that the atmosphere within the hyperbaric escape chamber is kept appropriate all the time. The autonomous life-support system of the hyperbaric lifeboat is to be independent with the saturation diving system on board an attendant ship or an offshore unit. The autonomous life-support system is to supply appropriate breathing gases to maintain the pressure within the hyperbaric evacuation chamber.

7.4.3 Autonomous life-support system is to be provided with two separate distribution systems for supplying sufficient oxygen to the hyperbaric escape chamber and components in the system are to be suitable for oxygen service. Sufficient oxygen is to be supplied based on the consumption of 30 L/h (under standard atmospheric pressure) for each diver. Oxygen is at least to be stored in two separate sets of air cylinders, and the air pipes are to penetrate the pressure hull of hyperbaric escape chamber respectively. Penetration is to be so arranged that the possibility of failure of both penetrations due to single accident is minimized.

7.4.4 Relevant equipment is to be installed at appropriate location to ensure the CO_2 level in the atmosphere within the hyperbaric escape chamber is kept within acceptable limits during the operation of life-support system. The redundancy configuration of carbon dioxide removal system is to be sufficient.

7.4.5 In order to keep the thermal balance within the acceptable limits during the operation of life-support system, hyperbaric lifeboat is to be provided with heating facilities for divers. Passive insulating, active or regenerative heating the breathing gas of divers, and heating diver's suit are acceptable methods to warm the diver.

7.4.6 Where it is intended that divers may be depressed within the hyperbaric lifeboat, provision is to be made for the necessary equipment and gases, including therapeutic mixtures, to enable the depression process to be carried out safely.

7.4.7 In addition to any controls and equipment fitted externally, hyperbaric escape chamber is to be provided with adequate controls within for supplying and maintaining the appropriate breathing mixtures to the occupants, at any depth down to the maximum operating depth. As far as practicable, the controls are to be capable of operation without the person who operates them having to remove his/her seat belt.

7.4.8 In addition to any instrumentation necessary outside the hyperbaric escape chamber, suitable instrumentation is to be provided within the chamber for monitoring the partial pressures of oxygen and carbon dioxide and be capable of operation for the duration of the available life-support period.

7.4.9 An adequate supply of food and water is to be provided within the hyperbaric lifeboat. In determining, in particular, the amount of water to be provided, consideration is to be given to the

area of operation and the environmental conditions envisaged.

7.4.10 The breathing system is to be provided with a sufficient number of masks for all occupants under pressure. Hyperbaric evacuation unit is to be provided with life-support system to supply appropriate breathing mixtures so that all divers may breathe through the masks of internal breathing system when the atmosphere environment within the hyperbaric escape chamber worsens. Emergency life support system is to be independent from the above mentioned autonomous life-support system. The system capacity is to be calculated based on 15l/min (under standard atmospheric pressure) when the diver rests still and 30l/min (under standard atmospheric pressure) when the diver engages in light work. In addition to the sufficient source of gas provided onboard the hyperbaric lifeboat, the breathing mixtures are also to be provided with gas interface from the supporting attendant ship or platform.

7.4.11 Provision is to be made external to the hyperbaric lifeboat and in a readily accessible place, for the connection of emergency hot or cold water and breathing therapeutic mixture. The connections are to be clearly and permanently marked and be suitably protected. Connections for emergency use are to comply with the provisions of IMCA D 051 “Requirements for Connections of Hyperbaric Evacuation System”.

7.4.12 In hyperbaric lifeboat designed to pass through fires, the breathing gas bottle and piping systems and other essential equipment are to be adequately protected. In addition, thermal insulation material is to be non-toxic and suitable for this purpose.

7.4.13 Before the hyperbaric lifeboat is released, first-aid equipment, sickness bags, paper towels, waste disposal bags and all necessary operational instructions for equipment and units are to be available within the hyperbaric escape chamber.

7.4.14 Arrangement for collection and discharge of sewage is to be fitted within the hyperbaric escape chamber of hyperbaric lifeboat. The arrangement is to prevent loss of pressure within the chamber due to accidental leakage during the release, recovery of hyperbaric lifeboat or in severe weather conditions. Flush type toilet which is capable of discharging sewage outside chamber is to be fitted with interlock to prevent flushing when in use.

7.4.15 In addition to the requirements above, the machinery and equipment together with the piping system used for the life-support system of hyperbaric lifeboat are to comply with the applicable requirements of Chapters 8 and 9 of CCS Rules for Construction and Classification of Diving Systems and Submersibles, including:

(1) 8.1.2, 8.1.3, 8.1.4.3, 8.2.4, 8.3.1, 8.3.2, 8.3.3, 8.4.1.2, 8.4.2, 8.4.3.1, 8.5.1.1, 8.5.4.2, 8.6.1 to 8.6.4, 8.9.1.1, 8.9.2.1 of Chapter 8;

(2) 9.1.2 to 9.1.5, 9.2.1 to 9.2.6, 9.3.1.1, 9.3.3.1 of Chapter 9.

7.5 Fire fighting

7.5.1 Materials used in the construction and installation are as far as is possible to be non-combustible and non-toxic.

7.5.2 A fire-extinguishing system is to be provided in the hyperbaric lifeboat which is to be suitable for exposure to all depths down to the maximum operating depth.

7.5.3 In hyperbaric lifeboats that are designed to float and may be used to transport divers through fires, consideration is to be given, where practicable, to providing an external water spray system for cooling purposes.

7.6 Electrical arrangements

7.6.1 All electrical equipment and installation, including the power supply arrangement, are to be designed for the intended operating environment. Electrical equipment within the hyperbaric escape chamber is to be designed for hyperbaric use, high humidity levels and marine application. For environmental conditions, see 10.1.2 of Rules for Construction and Classification of Diving Systems and Submersibles.

7.6.2 The maximum voltage of electrical equipment within hyperbaric escape chamber is to comply with the requirements of 10.1.3 of Rules for Construction and Classification of Diving Systems and Submersibles.

7.6.3 Hyperbaric lifeboat and equipment necessary for evacuation are to be supplied by main source of power and emergency source of power of the ship.

7.6.4 Hyperbaric lifeboat is to be provided with two independent sources of power which are sufficient for the life-support duration:

(1) main source of power sufficient for the supply of all necessary services①;
(2) emergency source of power supplying the emergency service②.
7.6.5 Battery charging arrangement is to be designed to prevent overcharging under normal or fault conditions. Battery storage compartment is to be provided with means to prevent overpressurization and any gas released be vented to a safe place.
7.6.6 Each hyperbaric escape chamber is to be provided with a source of lighting sufficient for the life-support time and of sufficient luminosity to allow the occupants to read gauges and operate essential systems within the chamber.
7.7 Handling system
7.7.1 The release and recovery systems of hyperbaric lifeboat are to comply with the applicable requirements of International Life-Saving Appliance (LSA) Code.
7.7.2 The release and recovery systems of hyperbaric lifeboat are to comply with the requirements of Guidelines and Specifications for Hyperbaric Evacuation Systems for release and recovery of hyperbaric evacuation systems.
7.8 Communications and locating systems
7.8.1 Hyperbaric lifeboats are to be provided with two-way VHF radiotelephone apparatus and search and rescue locating devices as required by regulations III/6.2.1 and 6.2.2 of International Convention for the Safety of Life at Sea.
7.8.2 A primary communication system fitted with voice calibration equipment is to be provided for direct two-way communication between divers and those outside the hyperbaric escape chamber. A secondary communication system is also to be provided.
7.8.3 Sound powered telephone may be adopted by secondary communication system.
7.8.4 In addition to the communication systems referred to in 7.8.2, a standard bell emergency communication tapping code is to be provided which meets the requirements of resolution A.583(14). Copies of the tapping code are to be permanently displayed inside and outside the hyperbaric escape chamber, and a hammer is to be permanently placed inside and outside the hyperbaric escape chamber
7.8.5 Hyperbaric lifeboats are to be provided with a strobe light and radar reflector.
7.8.6 Hyperbaric lifeboats are to be provided with a set of emergency position-indicating beacon.

8 Type test
8.1 Selection of sample boat
When carrying out type approval, each type of self-propelled hyperbaric lifeboat is to be type tested.
8.2 Type test items and requirements
The type test items of the hyperbaric lifeboat include visual examination, general test and additional test, which are to be carried out according to the items listed in Table 8.2(1), Table 8.2(2) and Table 8.2(3) respectively.

---

① Necessary services are those provided to keep the safety of all occupants in the hyperbaric escape boat when the boat is kept operating continuously to maintain its function.
② Emergency services are those to be kept operation when the main source of power failures. The shortest operation duration of emergency service is 72h. The examples of emergency services are as follows:
Monitoring of the condition of emergency battery;
Emergency lighting;
Emergency communications;
Emergency life-support system, including removal of carbon dioxide (unless manual system is used), gas analysis and temperature control and monitoring;
Alarm systems of the above emergency services.

Type test items of the hyperbaric lifeboat-visual examination

Table 8.2(1)

No.	Test items		Test methods and requirements
1	Measurement of main dimension		Allowable deviation of boat length: ±0.5%*L Allowable deviation of boat breadth: ±1.0%*B Allowable deviation of overall height: ±1.0%*H Allowable deviation of moulded depth: ±0.5%*D Hook center distance: ±0.5%*L1 Weighing empty boat: drawing compliance examination
2	Examination of height in the boat		LSA4.4.1.8
3	Examination of signs	Signs of starting engines and closing compartment doors	IMO A.760(18)
4	Examination of occupants and seats	Size	LSA4.4.2.2.2
		Indication	LSA4.4.2.3
		Arrangement	LSA4.6.2.10
		Safety belt	LSA4.6.3.1
5	Examination of power plant	Engine, battering casing	LSA4.4.6.2; LSA4.4.6.9
		Exhaust pipe arrangement	LSA4.4.6.6
		Propulsor safety	LSA4.4.6.7
		Operating instructions	LSA4.4.6.12
6	Release mechanism	Resetting sign	MSC.218(82)4.4.7.6.3,
		Maintenance equipment	MSC.218(82)4.4.7.6.7,
		Operating handle	MSC.218(82)4.4.7.6.6,
		Operating instructions, warning notice	MSC.218(82)4.4.7.6.5,
7	An adequate view from the control and steering position		LSA4.4.7.12
8	Color examination of hyperbaric lifeboats	Totally enclosed boats	LSA4.6.2.8
9	Examination of retro-reflective material		LSA1.2.7; IMO A.658(16)
10	Examination of outfits and equipment	Examination of boarding ladder	LSA4.4.3.3
		Examination of drain valve①	LSA4.4.7.1
		Examination of rudder	LSA4.4.7.2
		Examination of lifeline	LSA4.4.7.3
		Examination of hatches (totally enclosed boats)	LSA4.6.2.3; LSA4.6.2.4
		Examination of windows (totally enclosed boats)	LSA4.6.2.7
		Examination of handrails (totally enclosed boats)	LSA4.6.2.9
		Fitting of antenna (where applicable)	LSA4.4.7.8
		Examination of position indication lamp	LSA and MSC.218(82)4.4.7.10
		Examination of illumination lamp	LSA and MSC.218(82)4.4.7.11
		Examination of equipment	LSA4.4.8

① For non-watertight structure under the floor of the hyperbaric lifeboat, a drain valve must be provided near the lowest point in the hull. If there is only one compartment under the floor, or if there are multiple compartments connected to each other, a drain valve can be installed at the lowest point; if there are multiple compartments under the floor and they are not connected to each other, each compartment is to be provided with a drain valve at the lowest point. In this case, the self-ladling function cannot be realized, so a hand pump is also required. For watertight structure under the floor of the hyperbaric lifeboat, if there is no compartment under the floor of the hyperbaric lifeboat, or there is a compartment under the floor of the hyperbaric lifeboat sealed by a watertight cover, a drain valve is to be provided at the lowest point of the floor. The drain valve is provided with self-ladling function and a hand pump may not be omitted, provided that: it is arranged at the lowest point; it has

the ability to prevent seawater from intruding; it has a cover or plug at the opening position in the boat, and is connected to a fixed position by a rope or chain.

Type test items of the hyperbaric lifeboat-General test

Table 8.2(2)

No.	Test items	Test methods and requirements	
1	Hyperbaric lifeboat material tests	Material fire-retardancy test	MSC.81(70)Part1 6.2MSC/Circ.1006
2	Hyperbaric lifeboat overload test	Davit-launched hyperbaric lifeboat	MSC.81(70)Part1 6.3.1-6.3.6
3	Davit-launched hyperbaric lifeboat impact and drop test		MSC81(70)Part1 6.4 LSA4.4.1.5.2
4	Hyperbaric lifeboat seating strength test	Davit-launched hyperbaric lifeboat	MSC81(70)Part1 6.6.1
5	Hyperbaric lifeboat seating space test		MSC81(70)Part1 6.7 MSC.218(82)4.4.3.1,4.4.3.2
6	Hyperbaric lifeboat freeboard and stability tests	Flooded stability test	MSC81(70)Part1 6.8.1-6.8.3 MSC.226(82)LSA4.6.3.3 Paragraph 7.1 of A.692(17) on Guidelines and Specifications for Hyperbaric Evacuation Systems
		Recovery hook stability test	
		Freeboard test	MSC81(70)Part1 6.8.4; 6.8.5 LSA4.4.5.2
7	Release mechanism test	Davit-launched hyperbaric lifeboat	MSC81(70)Part1 6.9.1-6.9.3, 6.9.6, MSC.226(82) Part1 6.9.4 LSA4.4.7.6.2;LSA4.4.7.6.5 MSC321(89)Part1 .9.1-6.9.5
8	Hyperbaric lifeboat operational test	Operation of engine and fuel consumption test	MSC81(70)Part1 6.10.1 MSC.226(82),LSA4.4.6.8
		Engine out-of-water test	MSC81(70)Part1 6.10.5
		Compass performance test	MSC81(70)Part1 6.10.7
		Life-saving test	LSA4.4.4.3.4
9	Hyperbaric lifeboat towing and painter release test		MSC81(70)Part1 6.11

Type test items of the hyperbaric lifeboat-Additional test

Table 8.2(3)

No.	Test items		Test methods and requirements
1	Totally enclosed hyperbaric lifeboats	Self righting test	MSC81(70)Part1 6.14.1; 6.14.2 LSA4.6.3.1
		Flooded capsizing test	MSC81(70)Par1 6.14.3-6.14.5 LSA4.6.3.3
		Rowing test	LSA4.6.2.5
		Pressure test	LSA4.6.2.11
		Watertightness test①	LSA4.6.2.2
2	Fire protected hyperbaric lifeboats	Air supply test	MSC81(70)Part1 6.15 MSC.226(82)
		Fire test②	MSC81(70)Part1 6.16.1-6.16.7
		Water spray tests	MSC81(70)Part1 6.16.8-6.16.10
3	Recovery of totally enclosed hyperbaric lifeboats	Hook and unhook test③	Paragraph 11 of A.692(17) on Guidelines and Specifications for Hyperbaric Evacuation Systems
		Single-point lifting device strength test and lifting attitude control test	

① All openings and seams of the hyperbaric lifeboat are to be tested for watertightness. Use a nozzle with a diameter of 16mm, the water pressure is not less than 0.1MPa, the distance is not more than 3m, flush the water at the opening or the seam, and there is to be no obvious dripping on the other side (or equivalent method);

② The test samples of the hull material of the hyperbaric lifeboat must be pasted with the hull under the same conditions, materials, layer structure and craftsmanship;

③ According to the requirements of MSC.272 (85) and MSC.274 (85), the average weight of the occupants of the self-propelled hyperbaric lifeboat is adjusted from 75kg to 82.5kg.

9 Unit/batch inspection

9.1 To apply for the certificate of hyperbaric lifeboat marine products, the test items are to be in accordance with inspection and testing required for hull parts in “Unit/batch inspection after approval of lifeboat Table 9.1” of lifeboat (L-06) of CCS Guidelines for Survey of Marine Products.

9.2 The pressure hull of the hyperbaric escape chamber is classified as a Class I pressure vessel, and its inspection and test contents are to be in accordance with the requirements of CCS current

rules or relevant guidelines.

9.3 In addition to the inspections and tests required by 9.1 above, the following tests are required:

9.3.1 Visual examination

The arrangement, integrity and visual examination of the equipment and piping system of the hyperbaric lifeboat are to meet the requirements of the approved drawings.

9.3.2 Pipeline hydraulic test

All pressure-bearing pipelines, together with fittings, are to be subjected to internal hydraulic test of the pipeline before wrapping the thermal insulation material or applying the coating after the manufacturing is completed. The test pressure of each pipeline hydraulic test is to be 1.5 times the design pressure of the piping system.

9.3.3 Tightness test

(1) After the installation of the hyperbaric lifeboat system is completed, the air-tightness test of the hyperbaric escape chamber is to be carried out. The test medium is to be the working gas at the rated working pressure or a mixed gas of helium and nitrogen with a partial pressure of at least 10% helium. The test pressure is the maximum working pressure, and the pressure drop is to be less than 1% within 24 h. If the temperature change before and after the air-tightness test process is large, the final result can be obtained by correcting the calculation by means of the equation P1/T1=P2/T2.

(2) For each gas piping system, air tightness test is also to be carried out. The test pressure is the maximum working pressure. The test medium is to be clean and oil-free compressed air or nitrogen. The test pressure is the maximum working pressure, and the pressure drop is to be less than 1% within 24 h. If the temperature change before and after the air-tightness test process is large, the final result can be obtained by correcting the calculation by means of the equation P1/T1=P2/T2.

9.3.4 Insulation measurement, power control and change-over system test

(1) The insulation resistance of the main electrical equipment in the system is to be measured, and the measured value is to meet the relevant standards;

(2) Testing the normal operation of the low-insulation alarm and protection function, and the low-insulation protection function override of the power distribution box;

(3) Checking the charging functions of the main battery and the backup battery, and their respective charging functions are to be normal;

(4) Testing the switching function between the main battery and the backup battery. They are to work normally and the capacity is to meet the design requirements;

(5) The ventilation function of the battery is to be considered when charging to prevent the accumulation of dangerous gas, and the ventilation function and the charging function need to be interlocked.

9.3.5 Functional test of monitoring and communication system in the chamber:

(1) Turning on the main power control switch, turning on the hyperbaric chamber lighting switch, the chamber lighting is to work normally;

(2) Operating the helium voice phone according to the instruction manual, and the response is to be normal;

(3) Operating the voice intercom phone according to the instruction manual, and the response is to be normal;

(4) Turning on the monitoring system, checking the working conditions of the camera, the monitor and picture are to work normally;
(5) Turning on the temperature and humidity meter, both are to work and display normally;
(6) Turning on the oxygen and carbon dioxide detector, it is to work and display normally;
(7) Turning on the fixed fire detection and alarm system, it is to work normally;
(8)The internal pressure display and the external pressure display instrument are to be normal and the two are to be equal;
(9) Turning on the fans in the chamber, they are to work normally;
(10) Switching between the main power supply and the backup power supply, all the above equipment is to work normally.

9.3.6 Inspection and test of fire detection and extinguishing system:

(1) Carrying out a simulation test of the smoke detector in the hyperbaric escape chamber, and it is to work normally;
(2) Carrying out the test of high-pressure water fire extinguishing system, it is to work normally, the fire extinguishing ability is to be sufficient, the release time of the extinguishing medium is not to be less than 1 minute, the pressure drop is not to be less than 30% before the release, and the extinguishing medium can be released in mist under this pressure;
(3) Checking that the regular maintenance guidelines for the high-pressure fire extinguishing devices are posted as normal and it is easy to operate. The pressure gauge of the high-pressure water fire extinguishing system needs to clearly indicate the minimum release pressure indication area (displayed with color code) for easy examination.

9.3.7 Other functional tests:

(1) Carrying out functional examination of mating manholes and access manholes of the hyperbaric escape chamber to ensure that personnel can operate and lock the two manholes in the chamber smoothly;
(2) Testing the interlocking function of the toilet in the hyperbaric escape chamber to ensure that the drain valve cannot be opened when the toilet is in use;
(3) Testing the display function and alarm function of the oxygen analyzer, it is to work normally. The use of standard gas for calibration test is determined by the on-site surveyor according to the situation;
(4) Testing the display function and alarm function of the carbon dioxide analyzer, it is to work normally. The use of standard gas for calibration test is determined by the on-site surveyor according to the situation;
(5) Testing the interlocking function of the delivery barrel of the hyperbaric escape chamber, it is to work normally;
(6) Measuring the noise in the hyperbaric escape chamber when all systems are in normal operation, and the maximum noise value is to meet the noise requirements in the manned compartment in Section 7, Chapter 8 of CCS Rules for Construction and Classification of Diving Systems and Submersibles;
(7) Measuring emergency breathing apparatus: It can be carried out during the opening of the chamber. Compressed air is connected, the air supply valve is opened, the air supply pressure is set, the chamber is full, and the tester wears a breathing mask and breathes at the frequency of 18 ±2 times/minute. If the breathing is smooth, the respiratory resistance can be considered to meet the requirements; or a breathing simulator is used to measure the respiratory resistance of the

emergency breathing apparatus, and the test method and test results are to meet the requirements of GB/T 16560 Deck Decompression Chamber.

(8) The air supply panel is used to supply the chamber by means of the external supply pipeline and the spare cylinder in the boat, and their functions are normal, and the change-over function between the two is to be normal;

(9)Testing the switching control valve between other external pipelines and between internal and external pipelines, and the switching function is to work normally.

10 Others

Corresponding special signs are to be provided on the shell of the hyperbaric lifeboat to show the difference between the hyperbaric lifeboat and the ordinary lifeboat, so that attention can be paid during the rescue and avoid unnecessary damage to the divers in the hyperbaric escape chamber caused by misoperation.

10.1 Hyperbaric lifeboats are to be coloured orange and be provided with retro-reflective material to assist in their location during hours of darkness.

10.2 Each hyperbaric lifeboat designed to be waterborne is to be marked with at least three identical signs as shown below. One of these markings is to be on top of the unit and be clearly visible from the air and the other two be mounted vertically on either side and as high as possible and be capable of being seen while the unit is afloat.

Note: Dimensions in millimetres

10.3 The following instructions and equipment are to be clearly visible and be kept readily available while the unit is afloat:

(1) towing arrangements and buoyant towline;

(2) all external connections, particularly for the provision of emergency gas, hot/cold water and communications;

(3) maximum gross weight of unit in air;

(4) lifting points;

(5) name of the parent ship and port of registration; and

(6) emergency contact telephone, telex and facsimile numbers.

10.4 Where appropriate, the following instructions are to be permanently displayed on every hyperbaric lifeboat in two separate locations so as to be clearly visible while the unit is afloat:

“Unless specialized diving assistance is available:

(1) do not touch any valves or other controls;

(2) do not try to get divers out;

(3) do not connect any gas, air, water or other supplies;

(4) do not attempt to give food, drinks or medical supplies to the occupants; and

(5) do not open any hatches. ”

10.5 For diving systems that move and operate internationally, the language used for the above-mentioned logos and information of the hyperbaric lifeboat is to be at least Chinese and English.