GUIDANCE NOTES
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INTERNATIONAL SHIP CLASSIFICATION

GUIDELINES FOR SURVEY OF EXTERNAL ENVIRONMENTAL CONTROL UNIT FOR SATURATION DIVING SYSTEM

2021

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CONTENTS

1 Application

1.1 The Guidelines apply to the survey of external environmental control units provided for saturation diving systems.

2 Normative references

2.1 The survey of external environmental control unit is based on:

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

(2) ISC Rules for Classification of Sea-going Steel Ships;

(3) ISC Rules for Materials and Welding.

3 Definitions

3.1 External environmental control unit refers to the set of combined air circulating treatment unit outside the pressure vessel for human occupancy, which carries out the external closed circulation of the atmosphere of the pressure vessel so as to adjust and control the atmosphere of the pressure vessel (hereinafter referred to as environmental control unit).

3.2 Pressure vessel refers to the chamber enclosed by pressure hull to arrange for divers and/or necessary equipment and transfer of divers.

4 Plans and documents

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

4.1 General and machinery:

(1) General arrangement plan;

(2) Schematic diagram of the system;

(3) Detailed plans of mechanical equipment and connection of piping systems;

(4) List of mechanical equipment, associated piping and valves;

(5) Plan of mechanical equipment;

(6) Physical and chemical list of equipment and piping materials;

(7) Strength calculations for mechanical equipment and piping systems;

(8) Calculations (strength calculations, performance calculations and carbon dioxide removal calculations);

(9) Technical specifications;

(10) System specifications;

(11) Operation and maintenance manual.

4.2 Electrical installations

(1) General plan;

(2) Arrangement plan of panel;

(3) Technical conditions of product;

(4) Schematic diagram of electrical installations;

(5) Wiring diagrams;

(6) Specification list of associated electrical appliances;

(7) Product specifications.

4.3 Other plans and documents required by ISC are also to be submitted where necessary.

5 Raw materials and parts

5.1 Raw materials and spare parts are to meet relevant requirements of existing ISC rules.

6 Technical requirement for design

6.1 The environmental control unit is to be capable of providing services of heating/cooling, temperature control and carbon dioxide removal and its indicators are to meet the requirement of Sections 4 and 7, Chapter 8 of ISC Rules for Construction and Classification of Diving Systems and Submersibles.

6.2 The operation of the environmental control unit is not to lead to the occasion where the noise index within the pressure vessel for human occupancy exceeds the provision of 8.7.5, Chapter 8 of ISC Rules for Construction and Classification of Diving Systems and Submersibles.

6.3 The ventilation piping of the environmental control unit is to be proper in specification to ensure enough air circulation between the unit and the pressure vessel for human occupancy. The air exchange rate of ambient air within the pressure vessel, in general, is to be maintained at 6 to 10 times per hour while the airflow velocity of passers-by is to be maintained within the scope of 1 to 8 meters per minute.

6.4 The piping system of the environmental control unit is to have sound sealing property to ensure that the operation of the unit would not lead to unnecessary leakage of gas within the pressure vessel for human occupancy.

6.5 In addition to the above requirements, the machinery and equipment of the environmental control unit and its piping system are to meet the applicable requirements of Sections 1 to 4, Chapter 9 of ISC Rules for Construction and Classification of Diving Systems and Submersibles.

7 Unit/batch inspection

7.1 Unit/batch inspection is to include the following items:

(1) Visual examination;

(2) Pipeline hydraulic test;

(3) Tightness test of the system;

(4) Insulation measurement;

(5) Functional test.

7.2 Requirements for inspection and test

Product certificates are to be issued in accordance with ISC Instructions for Issuance of Marine Product Certificate to products applying for inspection after satisfactory inspection and test.

7.2.1 Visual examination

The whole set of the unit is to be examined to meet the requirements of the approved plans.

(1) Visual examination is to be carried out to major components of the system in accordance with the requirements of the plans, e.g. heating tank, refrigerating and dehumidifying tank, CO_2 absorption tank, refrigerating and heating equipment, electrical machinery, piping system and change-over valves;

(2) Each component of the product is to be fully equipped. The surfaces of each unit, tank and their insulation layer (if any) are to be intact. The arrangement of piping is to be in order and reasonable. The valves are to be fitted to facilitate operation and maintenance. The unit is to facilitate operation and maintenance. The fasteners are to be fitted to be firm and proper.

7.2.2 Pipeline hydraulic test

(1) Internal hydraulic test is to be carried out to all pressure-bearing gas piping, hot and cold medium water piping, cooling water piping and fittings after completion of manufacturing and prior to wrapping thermal insulation materials. The hydraulic test pressure is to be 1.5 times the design pressure of the piping system.

(2) Apart from the above internal hydraulic test, the piping system bearing external pressure is to be subject to external hydraulic test. The test pressure is to be 1.5 times the design pressure borne externally.

7.2.3 Tightness test of the system

Tightness test is to be carried out after the completion of installation of the environmental control unit. The test medium is clean and oil-free helium-nitrogen mixture with at least 10% content of helium volume. The test requires that the drop of pressure within 24 hours under the maximum working pressure is less than 1%. 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.

7.2.4 Insulation measurement

Insulation measurement is to be carried out prior to the functional test. The insulation resistance of routes within the switchboard against the equipment hull is to be not lower than 5MΩ and the insulation resistance among wiring terminals is to be not lower than 100MΩ.

7.2.5 Functional test of the environmental control unit

After the completion of assembly of the environmental control unit, the system is to be connected with the pressure vessel for human occupancy for simulation test to carry out functional test. The connection method is to be determined by the manufacturer and agreed by ISC. The test items are

mainly as follows:

(1) verification of the engaging pressure of safety valves fitted to the environmental control unit;

(2) functional test to the tank switch safety interlock of CO_2 absorption tank;

(3) testing the remote control and local control function of hot and cold water flow used for refrigerating and heating, and testing the change-over function between remote and local control;

(4) testing the refrigerating and heating function of cold and heating medium unit;

(5) testing the automatic temperature control and relevant alarm function for refrigerating and heating of cold and heating medium unit;

(6) change-over test and emergency stop functional test for automatic control function and manual control function of cold and heating medium unit;

(7) functional test of automatic/manual change-over to standby cold and heating medium unit in case of malfunction of the main cold and heating medium unit (where applicable);

(8) noise test under normal operation of the draught fan of the environmental control unit. The maximum noise value is to meet the requirements of noise in the manned compartment in Section 7, Chapter 8 of ISC Rules for Construction and Classification of Diving Systems and Submersibles.

(9) other tests deemed necessary by the site surveyors;

(10) test and verification are to be carried out to the temperature and humidity control capacity indicator, control precision indicator and CO2 absorption capacity indicator of the system in accordance with the design requirements. Where the tests cannot be conducted by the manufacturer, relevant tests may be carried out after the completion of installation of the unit and the whole diving system, upon application by the manufacturer.

8 Others

Functional test is to be carried out in accordance with requirements where the environmental control unit is provided with monitoring alarm system for rotate speed of draught fan or bearing temperature (if any).