Guideline No. T-15(202502)

T-15

Gas Combustion Unit

Issued date: February 1, 2025

Foreword

The product inspection guideline of China Classification Society (hereinafter referred to as "CCS") specifies the applicable technical requirements and inspection and test requirements for classification products and authorized statutory products of ships to be approved/inspected by CCS.

The Guidelines allow users to adopt alternative test methods and requirements, provided these methods and requirements meet or exceed the standards set by the Guidelines.

The Guidelines are prepared and updated by CCS and published on http://www.ccs.org.cn. In case of any comments and suggestions, please contact CCS via service@ccs.org.cn.

Historical release version and release time: newly edited

Main modifications in this version: None

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Gas Combustion Unit

1 Scope of Application

1.1 The Guidelines are applicable to gas combustion unit installed and used for handling excess goods vapours in ships transporting liquefied gases.

2 Normative References

(1) Chapters 7 and 16, Part 3 of the CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk

(2) Chapters 7 and 16 of amendments of Resolution MO MEPC.370 (93) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)

(3) Chapters 2 and 3 of Part 3 and Chapter 3 of Part 4 of CCS Rules for Classification of Sea-Going Steel Ships

(4) CCS Rules for Materials and Welding

3 Terms and Definitions

The terms and definitions defined in the above normative reference documents are applicable to the Guidelines. The following definitions are supplemented in the Guidelines.

(1) Gas combustion unit (GCU): Means a unit in which excess goods vapours are treated by thermal oxidation.

(2) Gas valve unit (GVU, GVT): It’s a unit consisting of valves, pipelines and control equipment used to control and regulate the gaseous fuel supply.

4 Drawings and Data

4.1 The following drawings and data shall be submitted for review:

(1) Main technical parameters of products;

(2) Arrangement plan of gas combustion unit;

(3) System schematic diagram, electrical schematic diagram and work flow chart;

(4) General assembly drawing;

(5) Structure diagram of combustor;

(6) List of main equipment and components;

(7) Fault modes and effect analysis ;

(8) List of safety protection fault alarm items and set values;

(9) Calculation sheet (pipeline strength, fan ventilation rate/flow, etc.);

(10) Product operation instructions.

5 Technical Requirements

5.1 The gas combustion unit shall be free of externally visible flame, and the flue exhaust temperature shall be kept below 535 °C.

5.2 The gas combustion unit shall have a special forced ventilation system, and the combustion chamber and flue exhaust shall be designed to prevent any accumulation of gases.

5.3 The gas combustion unit shall be equipped with an effective ignition device and a flame detector. In case of ignition failure or fault flameout, the gaseous fuel can be automatically shut down.

5.4 The gas combustion unit control system shall ensure that gas combustor cannot be ignited before the forced air supply and dilution fan flow are established. The fan flow shall meet the requirements of design calculation sheet.

5.5 The gas combustion unit shall be provided with an effective automatic shutdown device and a manual shutdown valve on the gas supply pipeline to each combustor.

5.6 After the flame is extinguished, the gaseous fuel shall be effectively cut off and the gaseous fuel supply pipeline shall be automatically purged with inert gas.

5.7 The combustion chamber shall be capable of manual purging, and in the event that the flame is extinguished, it shall automatically carry out purging before re-ignition.

5.8 The gaseous fuel supply pipeline shall meet the relevant requirements of Article 16.4, Chapter 16, Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

5.9 If a gas leakage detection device is installed, it shall meet the relevant requirements of Chapter 16, Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

5.10 Where only GCU is used as the means of controlling the cargo pressure/temperature, in normal conditions the moving parts e.g. blowers, the essential electronic control units in the monitoring system are to be provide with dual redundancy arrangement, so as to ensure that in case of single failure of a part, the processing capability can be kept or recovered. For a ship with type C independent cargo tanks, single redundancy is allowed provided the following conditions are fulfilled: spares can be replaced in a short period, the recovery time of GCU processing capability is in line with the expected operational characteristics of GCU and cargo tank pressure increase rate;

5.11 The combustion chamber wall shall be made of insulating refractory, or provided with a cooling system, or both. Hot surfaces that may come into contact with crew members during operation shall be suitably guarded and the guarded hot surface shall not exceed 60°C.

5.12 The gas combustion unit control system shall have the function of goods emergency shutdown (ESD) system control as specified in Article 18.10.3, Chapter 18, Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

5.13 Electrical equipment suitable for use in hazardous areas or atmospheres with explosive gases shall be certified explosion-proof type.

6 Raw Materials, Parts and Components

6.1 Main components of gas combustion unit: heat exchanger (if any), emergency shutdown valve, safety valve (if any), gas valve unit (GVU/GVT), combustor, combustion chamber, fan, exhaust pipe, instrument, pipeline and electrical control box, etc.

6.2 Fans, heat exchangers, emergency shutdown valves, gas valve units (GVU/GVT), combustors, safety valves (if any) and electrical control boxes shall be provided with CCS marine product certificates.

7 Type Test

7.1 Selection of typical samples

If you apply for CCS product approval, the products used for type test shall be able to represent the design and manufacturing capacity of the factory in terms of characteristics, design principles and manufacturing processes.

7.2 Test items

(1) Welding procedure qualification;

(2) NDT of welds;

(3) Visual survey of welds;

(4) Pressure test;

(5) Function test;

(6) Safety protection and alarm function test.

7.3 The test methods and technical requirements shall meet the following requirements:

(1) Welding procedure qualification

The welding procedure qualification of gaseous fuel pipeline shall be

carried out in accordance with the relevant requirements of 6.5.4, Chapter 6, Part 3 of Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk and Rules for Materials and Welding, which shall be confirmed and approved by CCS. Other pressure pipeline shall be carried out in accordance with the relevant requirements of the Rules for Materials and Welding.

(2) NDT of welds

Welds of gaseous fuel pipeline shall be subject to NDT in accordance with the requirements of 16.4.7 in Chapter 16, Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk. Other pressure pipeline shall be carried out in accordance with the relevant requirements of the Rules for Materials and Welding.

(3) Visual survey of welds

Weld appearance survey shall be carried out for welded structural parts and pressure pipelines. The weld surface shall be free of cracks, overlaps, pores, undercuts and unfilled craters and depressions.

(4) Pressure test

Gaseous fuel pipelines and other pressure pipelines shall be subject to strength pressure test with appropriate medium. The test pressure is 1.5 times of the design pressure, and the test duration is 30 minutes.

After the pipeline system is assembled, a tightness test shall be carried out. The test pressure shall be the design pressure and the test duration shall be 10 minutes.

(5) Function test

The function test shall meet the relevant requirements of Article 5 of the Guidelines and shall at least include the following tests:

① Function test of ignition device;

② Purging function test of combustion chamber;

③ Measurement of combustion exhaust gas temperature at maximum gaseous fuel supply (if feasible);

④ Flame stability test with varying and minimum gaseous fuel supply.

(6) Safety protection and alarm function test

The alarm function shall be verified according to the safety protection measures approved by the CCS, including at least:

① High combustion gas outlet temperature;

② Failure of combustion air supply;

③ Failure of cooling or dilution air supply;

④ Failure of gaseous fuel supply (BOG flow, temperature and pressure);

⑤ Fault fire and ignition failure.

8 Unit/Batch Inspection

8.1 The on-site surveyor shall conduct survey one by one and check the product certificates of components and material quality certification documents.

8.2 Test items

(1) Gaseous fuel pipelines and other pressure pipelines shall be subject to welding procedure qualification in accordance with the requirements of Article 7.2 of the Guidelines, and the applicability of welding procedure shall be checked during survey;

(2) Gaseous fuel pipelines and other pressure pipelines shall be subject to NDT report review and weld appearance survey in accordance with Articles 7.3 and 7.4 of the Guidelines;

(3) Gaseous fuel pipelines and other pressure pipelines shall be subject to strength pressure test and tightness test according to the requirements of Article 7.3 (4) of the Guidelines;

(4) Function test required by Section 7.7 of the Guidelines;

(5) Safety protection and alarm function test required in Article 7.8 of the Guidelines.

8.3 If the above test items cannot be carried out in the manufacturing site, they can be carried out on board after the gas combustion unit is installed, and the test items that need to be witnessed by the surveyor on board shall be indicated on the product certificate.