Guideline No.B-04 (201510)

B-04 Boiler Burning Unit

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Foreword

This Guideline is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

This Guideline is published and updated by CCS and can be found through http://www.ccs.org.cn. Comments or suggestions can be sent by email to ps@ccs.org.cn.

Historical versions and release date:

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Boiler Burning Unit

1 Application

1.1 This Guideline applies to the associated burning unit mainly including burner, fuel pump set, power pipeline (fittings included) and electrical control device for marine boiler and thermal oil heater.

1.2 The burner is mainly of mechanical pressure type, rotary cup type, and steam atomizing type, etc.

1.3 The burning unit involved in this Guideline applies to boilers and thermal oil heaters with CCS class notation of AUT-0. Products used in marine boilers and thermal oil heaters with other CCS class notation are to meet the application requirements of CCS.

2 Basis for approval and inspection

2.1 The following standards are the bases for approval and inspection in this Guideline:

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

(2) Article 32 of *International Convention for the Safety of Life At Sea.*

3 Terms and definitions

3.1 The terms and definitions given in CCS Rules for Classification of Sea-going Steel Ships apply to this Guideline.

3.2 Relevant terms and definitions of this Guideline are as follows:

(1) Mechanical pressure burner: burning unit makes fuel atomized and burned under fuel pressure;

(2) Rotary cup burner: device where fuel film is generated through a high-speed rotary cup and thrown out of the cup and shattered into mist by high-pressure atomizing air and mixed with combustion-supporting air to burn;

(3) Steam atomizing burner: device where fuel is shattered into mist through the scouring effect of steam and mixed with combustion-supporting air to burn;

(4) Normal combustion: Under the stated conditions, the flame of fuel is stable without blow off and black smoke;

(5) Safety time: In order to ensure the safety operation of burning unit, when the burner is in no flame condition, the maximum time of open state allowed for fuel inlet valves.

4 Plans and documents

4.1 The following plans and documents are to be submitted to CCS for approval:

(1) Main product performance specification table;

(2) General assembly plan;

(3) Main parts plans: outline dimensional plan of burning casing, electric control box and etc.;

(4) System schematic diagram or P&ID ,safety alarm device;

(5) Calculation book (if applicable);

(6) When applying for design or type approval, the type approval test program are to submit to CCS.

4.2 The following plans and documents are to be submitted for information:

(1) Operation Instructions.

5 Materials and components

5.1 Main parts:

(1) Materials and components are to be controlled according to relevant requirements of CCS Rules currently in effect;

(2) Mechanical pressure burner mainly includes: blower, spray nozzle, flame safeguard, solenoid valve, fuel pump, servo motor, flame-out protection device (flame monitoring device), ignition device (electric spark generator), fuel heater (applicable to heavy fuel), various monitoring switches and controllers and fuel pump sets and power pipeline, etc.;

(3) Rotary cup burner mainly includes: rotary cup, rotary cup driving system, quantitatively-metered fuel supply device, blower, air regulation and distribution device, air-fuel proportion regulation device, process controller, ignition device, flame detection device, various monitoring switches and controllers, fuel heater and fuel control device (heavy fuel burner), fuel pump sets and power pipeline, etc.;

(4) Steam atomizing burner mainly includes: spray nozzle (atomizer included), fuel supply/regulation/control device (fuel heater is to be provided for burning heavy fuel), atomizing steam and flushing steam control device, blower, air regulation/distribution device, air-fuel proportion regulation device, ignition device, flame-out protection device (flame monitoring device), main spray nozzle limit switch, various monitoring switches and controllers, pneumatic valve control device, fuel pump set and power pipeline, etc.;

5.2 The following parts are to be with marine product certificate issued by CCS:

(1) Electric control box.

5.3 The following parts are to be with quality certificates issued by the manufacturer:

(1) Electromotor;

(2) Blower;

(3) Flame monitor;

(4) Ignition transformer;

(5) fuel spray (injector) nozzle;

(6) Solenoid valve;

(7) Fuel pump;

(8) Material for main parts;

(9) Process controller;

(10) Fuel heater (if applicable);

(11) Flexible hose;

(12) Various monitoring switches.

6 Design and technical requirements

6.1 Environmental conditions

Boiler burning unit is to be capable of working normally on the ship with a heel of ± 15°, a roll of ± 22.5°, a trim of ± 5° and a pitch of ± 7.5° at ambient temperature of 0℃ ~ 45℃;

6.2 Working sequence

Burning process is to be controlled according to the sequence "blower start——pre-purge——medium atomization type: establish ignition flame through atomizing medium; Non-medium atomization type: establish low fire main flame by lighting main fuel with electric sparker——burning normally——flame extinction——post-purge——shut down";

6.3 Fittings and system arrangement

(1) Main boiler, auxiliary boilers for essential services or for supplying steam for heavy fuel heating are to be equipped with at least two fuel supply devices, each of which generally includes one pressure pump (applicable to pressure type burner), one sucking filter, one discharge filter and one heater;

(2) When gravity feed is applied, double filters are to installed on the pipeline supplying fuel to burner;

(3) In the case that burner is connected with steam purging or atomizing devices, effective measures are to be taken to prevent fuel from entering into steam system;

(4) Burner is to be set in such a way that it will cut off fuel supply automatically when being swing out;

(5) One quick-closing master valve is to be installed on fuel supply pipeline to each boiler or thermal oil heater. The master valve is to be placed in proper position for direction operation in case of emergency or for remote control. Boiler or thermal oil heater with an CCS class notation are to meet the requirements of Part Seven of *CCS Rules for Classification of*

Sea-going Steel Ships;

(6) When burner flame failure, fuel supply of burner is to be cut off automatically and audible and visual alarm is to be given;

(7) Reliable no-trturn control device is to be installed to prevent fuel from flowing from fuel return system into burner after fuel supply of burner is cut off;

(8) The flue gas inlet of combustion chamber using fuel and flue gas alternatively is to be installed with partition and interlock device to enable fuel to go into burner only after the flue gas inlet is cut off.

6.4 Material

Material of burner is to withstand the mechanical force and thermal stress under service conditions in the long run. Metal materials are to be wear-resistant, heat-resistant and corrosion-resistant, suitable for the service conditions and anticorrosive coating is to be applied if necessary. Nonmetal materials are to be wear-resistant, heat-resistant and corrosion-resistant, suitable for the service conditions. Fuel pipe and its valves and fittings are to be made of steel or other equivalent materials. Fuel pipe is to be seamless steel pipe or welded pipe manufactured according to welding procedure approved by CCS.

6.5 Electrical control box

Electrical control box is to meet the applicable requirements of Part Four and Part Seven of *CCS Rules for Classification of Sea-going Steel Ships*. Process controller is to meet the requirements of Chapter 2, Part Seven of *CCS Rules for Classification of Sea-going Steel Ships*.

6.6 Safety control and protection

(1) Manual control and automatic control: Burner is to work normally under manual control and automatic control; the manual control system is to be independent relative to the automatic control system of burner. In case of malfunctions in one control mode, the other one is not to be affected;

(2) Safety time: For burner with independent ignition device, if ignition fails, ignition device and injection and inlet valves are to be closed automatically and the time from open state to closed state of fuel inlet valve is to be not more than 15 s; for direct ignition burner, the time from open state to closed state of fuel inlet valve is to be not more than 6 s; all types of burner are to be equipped with flame monitor which is capable of automatically cutting off the fuel inlet valve in case of flame failure due to malfunction in no more than 6 s after flame failure;

(3) Purge time: Pre-purge time is to be long enough to ensure 4 times of ventilation of combustion chamber. In the case of purge, air damper of air regulation shall be in the position corresponding to high load and the post-purge time is normally not less than 15 s;

(4) Emergency stop: The boiler is to be stopped immediately under circumstances of power failure or supply voltage being lower than setting value, ignition failure, flame failure, low pressure of combustion-supporting air, atomizing medium pressure being lower than setting value of detector switch, water level of boiler being lower than limit of low water level,

blower motor overload, heated medium temperature or pressure exceeding setting value and burner swing out;

(5) Fuel temperature control or viscosity control (CCS class notation of AUT-0): For heavy fuel, in the case that fuel temperature is lower than the setting value (or fuel viscosity is higher than the setting value) and fuel temperature is higher than the setting value (or fuel viscosity is lower than the setting value), audible and visual alarm is to be sent; in case that fuel temperature is lower than setting value of fuel low temperature (or fuel viscosity is higher than setting value of viscosity) and fuel temperature is higher than the setting value of low fuel temperature (or fuel viscosity is lower than the setting value of viscosity), burner is to stop burning and give audible and visual alarm. Boiler burning unit with other CCS class notation is to meet the requirements of Part Seven of *CCS Rules for Classification of Sea-going Steel Ships*;

(6) Fuel pressure control: In the case that fuel pressure is lower than the setting value, audible and visual alarm is to be given and spare fuel supply pump is to start automatically;

(7) All alarms are to be of audible and visual;

(8) Observation hole is to have safety protection measures.

6.7 Combustion performance

(1) Ignition: In the ignition, volume of air supply and that of fuel supply are to be the lowest value in the air and fuel regulation ranges and burner is to establish ignition flame or low fire flame of main fire; ignition is to be done after air gets into combustion chamber and pre-purge is completed;

(2) Atomization property: it is to meet the requirements of normal combustion;

(3) Flame stability: Within the minimum and maximum injection quantities, flame is to change stably and continuously without obvious vibration, deflection, blow off and black smoke and flame out;

(4) Flame size: Under the maximum injection quantity, the length and diameter of a normally burning flame is to be less than the length and diameter of combustion chamber;

(5) Coking and carbon deposition: After continuous operation of burner, coking and carbon deposition of circle exit are not to affect fuel combustion performance or cause coking in the combustion chamber;

(6) Full combustion: Full combustion of fuel is to be considered in design;

(7) Stability of injection quantity: When burner runs under any working condition, the deviation between the actual injection quantity and the specified value in design is to be within ± 5%;

(8) The design, installation and adjustment of fuel injector, diffuser and air regulator are to ensure that fuel can burn completely and that flame won’t have harmful effects on combustion chamber surface and tube; sparking device is to be arranged reasonably to prevent fuel from leaking and to prevent flame from being blown out of the combustion chamber.

6.8 Strength of burner pump unit and pipeline, atomization pipeline and valve

Burner pump units and pipeline, atomization pipeline and valve are to withstand 1.5 times the design pressure in hydraulic test without obvious deformation or leakage.

7 Type test

7.1 Selection of typical sample

The most representative type is to be selected according to the characteristics of fuel types and test is to be carried out to the fuel with highest viscosity.

7.2 Type test items and requirements

(1) Environmental conditions: Under the “environmental conditions” (if applicable) of “Design and Technical Requirements” as stated above, burning unit is to work normally;

(2) Testing fuel: Test is to be carried out with fuel type suitable for burning unit; burner, which uses low-sulphur fuel oil (LSFO) or heavy fuel, is to be tested with a proper method to ensure its adaptability and safety. The test is generally done in manufacturing factory at least when the first burner is installed onboard and put into operation;

(3) Inspection of fittings and system arrangement requirements: They are to meet the requirements of “Fittings and system arrangement” of “Design and Technical Requirements” as stated above;

(4) Material inspection: Materials are to meet the requirements of “materials” of “Design and Technical Requirements” as stated above;

(5) Strength test of fuel pump set and pipeline, atomization pipeline and valve: The test is to meet the requirements of “Strength of burner pump unit and pipeline, atomization pipeline and valve” of “Design and Technical Requirements” as stated above;

(6) Sequence control test: It is to meet the requirements of “working sequence” of “Design and Technical Requirements” normally as stated above;

(7) Safety control and protection test: The test is to meet the requirements of “Safety control and protection test” of “Design and Technical Requirements” as stated above;

(8) Combustion performance test: The test is to meet the requirements of “Combustion performance” of “Design and Technical Requirements” as stated above;

8 Unit/batch inspection

8.1 Inspection items

(1) Marine product certificate issued by CCS or quality certificate issued by the manufacturer;

(2) Check of records, reports and inspection and test conditions: check quality certificate of materials and/or report of physicochemical properties of main product parts manufactured in the manufacturing factory; check quality certificate and relevant certificates of main purchased parts and outsourced parts; check inspection, measurement and test conditions of

the manufacturing factory and provide the lists of test equipment and inspection equipment and valid verification documents; check test reports of the manufacturing factory: including product or sample type, specification, serial number, test site, date, test environment, test items and test data, conclusion of inspection and test and problems found in inspection and test and explanation on handling.

8.2 Unit/batch inspection and test items after approval

(1) Sequence control test (Light diesel oil may be used for test);

(2) Inspection of fittings and system arrangement requirements;

(3) Structural and visual inspection;

(4) Material examination;

(5) Safety control and protection test;

(6) Strength test and tightness test of fuel pipeline and atomization pipeline.