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TSG Safety Technical Code of Special Equipment

TSG ZB001-2008

Safety Technical Regulation for Oil and Gas Burners

燃油（气）燃烧器安全技术规则

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Introduction

In November 2004, the State Administration of Quality Supervision, Inspection and Quarantine (hereinafter referred to as AQSIQ) - Special Equipment Safety Supervision Bureau (Hereinafter referred to as Special Equipment Bureau) proposed the working plan of safety technical regulation's formulation and revision. In March 2005, China Special Equipment Inspection and Research Institute (hereinafter referred to as China Special Inspection Institute) organized the drafting group; held the first meeting of the drafting group in Shanghai; determined the drafting working principles, main contents, main problems, and structure (chapters) framework. In July 2005, it formed the first draft of this Regulation, and convened a second drafting working meeting that was participated by the drafting group and relevant experts, and the first draft was discussed and reviewed. In June 2006, Special Equipment Bureau, in Quality-Inspection-Special-Letter [2006] No. 31, sought the opinion with grassroots departments, relevant organizations and experts, and citizens. In July 2006, it was submitted to Special Equipment Safety Technical Committee of AQSIQ for review. In September 2007, it was notified to WTO / TBT member-countries for assessment. In January 8, 2008, it was approved-promulgated by AQSIQ.

Whether burners are able to operate properly is not only related to safety, but also related to environmental protection and energy saving. In order to ensure the safe operation of the burner, taking into account the environmental and energy requirements, it specifies the oil and gas burners' structure and design, installation and system, Operation and maintenance, safety and control devices, technical data and nameplate requirements etc.

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Table of Contents

Chapter 1	General Provisions	5
Chapter 2	Structure and Design.....	7
Chapter 3	Safety and Control Devices	10
Chapter 4	Installation and System.....	15
Chapter 5	Operation and Maintenance.....	17
Chapter 6	Technical Documents and Nameplates.....	19
Chapter 7	Supplementary Provisions.....	21
Appendix A	Definition for Models of Oil and Gas Burners.....	22
Appendix B	Requirements for the Arrangement of Safety Shut-off Valve of the Pressure Atomizing Oil Burner	23
Appendix C	Requirements for the Safety Time and Maximum Permissible Starting Thermal Power of the Oil Burner.....	27
Appendix D	Terms	28
Attachment 1	"Safety Technical Regulation for Oil and Gas Burners" (TSG ZB 001-2008) No.1 Amendment	31

Safety Technical Regulation for Oil and Gas Burners

Chapter 1 General Provisions

Article 1 This Regulation is formulated to ensure the safe operation of oil (gas) burner (hereinafter referred to as "the burner"), avoid and reduce accidents from oil and gas equipment, ensure life safety and reduce property loss.

Article 2 This Regulation is applicable to burners for various oil and gas boilers, and burners for other purposes may refer to this Regulation.

Article 3 This Regulation specifies the requirements for the burner with regard to its structure and design, safety and control devices, installation and system, operation and maintenance, technical documents and nameplate etc..

The dual fuel burner shall simultaneously meet the requirements for oil burner and gas burner as specified in this Regulation.

The safety performance of the electrical control system for the burner shall meet those specified in relevant technical regulations or corresponding standards.

Article 4 Without influencing the safe operation of burners, the fuel oil for oil burner shall reach the viscosity as required for its normal combustion at the burner inlet.

Article 5 After the final design of new products, they shall be subjected to type test carried out by the type test organization with the burner type test items approved by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (hereinafter referred to as "AQSIQ") and may then be put into use only after the type test certificate is obtained, and shall be inspected randomly once for four years.

Burners meeting any of the following requirements shall also be subjected to the type test:

- (1) If it is the first burner manufactured by the manufacturing organization;
- (2) If the manufacturing organization re-manufacture the burner after having stopped its manufacture for one or more years;
- (3) If safety technical codes have requirements.

Chapter 2 Structure and Design

Article 7 Burners shall be such designed to meet the following requirements:

- (1) Performances like the output thermal power of the burner shall be able to reach those specified;
- (2) Each part's structure and its dimension shall be such designed to be able to ensure the reliable and economic operation of burners while the safety of operating personnel is ensured, and phenomena endangering the equipment safety, like structural instability, deformation or cracking, shall be avoided;
- (3) For burners equipped with flame observation aperture, accessories of such observation aperture shall be possessed of adequate strength and be sealed tightly to avoid flaming out or flue gas leaking out;
- (4) Moving parts (fan and belt gear etc.) of burners must be designed with protective devices to prevent foreign matters in influencing the normal and safe operation of equipment, and the burner fan inlet shall be equipped with reliable protective net enclosures;
- (5) Air control devices shall be provided, and if the damper regulator is arranged for them, it shall be clearly indicated for its position;
- (6) For the multi-stage control or continuous control burner, its air and oil (gas) control devices may be linked mechanically, electrically or in other modes.

Article 8 In addition to meeting those required in Article 7, the gas burner shall also be such designed to meet the following requirements;

- (1) Burners with the rated output thermal power greater than or equal to 350kW shall be arranged with gas flow control device to ensure the adjustability of the output thermal power within specified range, and the gas flow control device of continuous control burner shall be clearly indicated;

- (2) Filter device is

arranged at the inlet of the gas control valve, and the bore diameter of filter is not greater than 1.5mm; permanent pressure testing points are arranged at both the inlet and the outlet of the filter.

Article 9 All parts of the burner shall be made of appropriate materials to avoid the reduction of its safety performance and operating characteristic during its normal operation. Materials for manufacturing the burner shall meet the following requirements:

Chapter 3 Safety and Control Devices

Article 13 Burners shall be equipped with ignition devices and able to ensure the safe ignition of ignition burner or main burner.

Article 14 The burner shall be equipped with flame monitoring device which shall meet the following requirements:

- (1) Capable of verifying whether the flame exists;
- (2) The flame monitoring device shall be installed at such position to avoid the interference of the external signal;
- (3) On the occasion where the ignition flame and main flame are respectively arranged with independent flame monitoring devices, the ignition flame shall not influence the detection to main flame.

Article 15 For the pressure atomizing oil burner with the rated oil level less than or equal to 100kg/h, the safety shut-off valve shall be arranged between the oil pump and nozzle as required from Figure B-1 to Figure B-4 in Appendix B, and the following requirements shall also be met:

- (1) The single-stage burner shall be arranged with at least one set of safety shut-off valves (see Figure B-1 in Appendix B);
- (2) For the two-stage or multi-stage control burner, each nozzle shall be arranged with one set of safety shut-off valves (see Figure B-2 in Appendix B);
- (3) For the burner equipped with return-oil nozzle, both its oil supply pipe and return oil pipe shall respectively be arranged with one set of safety shut-off valves;
- (4) If the nozzle shut-off valve, through testing, may serve as the safety shut-off device, then both the oil supply pipe and return oil pipe may respectively be arranged with nozzle shut-off valves;
- (5) If the fuel oil atomizer adopts the return-oil nozzle and the fuel oil level is greater than 30kg/h, then the oil pressure monitoring device shall be arranged on the return oil pipe to monitor the pressure in such pipe (see Figure B-3 and Figure B-4 in Appendix B).

The safety shut-off valve and the oil pump may be unitized.

Article 16 For the pressure atomizing oil burner with the rated oil level less than or equal to 100kg/h, the safety shut-off valve shall be arranged between the oil pump

- (5) If the ignition burner is arranged independently, the main gas control valve may open only after the flame has been ignited and verified with flame monitoring device to ignite the main flame.

Article 19 Both the ignition safety time and the extinction safety time of oil burner shall be as specified in Table C-1 of Appendix C.

Article 20 Each safety time of the gas burner shall meet the following requirements:

- (1) The ignition safety time shall not exceed 5s;
- (2) The main flame safety time shall not exceed 5s;
- (3) The extinction safety time shall not exceed 1s.

Article 21 Before the ignition of burner, combustion chamber and flue duct must be purged.

Article 22 The pre-purging time and pre-purging air volume of the oil burner shall meet the following requirements:

- (1) For the burner with the rated oil level less than or equal to 30kg/h, the pre-purging time of fan shall not be less than 5s under full open condition;
- (2) For the burner with the rated oil level greater than 30kg/h, its pre-purging air volume may be less than the air flow under rated output thermal power, shall be inversely proportional to the air flow, but not less than 20s; the purging air volume shall not be less than 50% of the air volume required for the maximum input heat of the heating device.

In addition to those required in (1) and (2) of this article, the pre-purging time and pre-purging air volume must also meet the relevant requirements in the matching safety technical code for heating device.

Article 23 The pre-purging time and pre-purging air volume of the gas burner shall meet the following requirements:

- (1) Pre-purging shall be carried out with the air flow under rated output thermal power, with the time not less than 20s;
- (2) Pre-purging shall be carried out with the air flow under the thermal power less than the rated output one, and the pre-purging time shall be inversely proportional to the air flow; the minimum purging air flow shall not be less than 50% of the rated air flow.

In addition to those required in (1) and (2) of this article, the pre-purging time and pre-purging air volume must also meet the relevant requirements in the matching safety technical code for heating device.

Article 24 Oil burners with the rated oil level less than or equal to 100kg/h may be directly ignited under full thermal power; those with the rated oil level greater than 100kg/h may not be, for which the maximum permissible starting thermal power, Q_{amax} , is such detailed in Table C-2 of Appendix C.

Article 25 Gas burners with the rated output thermal power less than or equal to 120kW may be directly ignited under full thermal power; for those with the rated output thermal power not greater than 120kW, the corresponding ignition thermal power shall not be greater than 120kW or 20% of the rated output thermal power.

Article 26 During starting and operation of burners, fuel supply shall be cut off automatically in safety time and the system shall be interlocked safely under any of the following conditions:

- (1) At the starting of burners, the flame is detected in pre-purging time, but not in ignition safety time;
- (2) The flame extinguishes suddenly during the normal operation of burners;
- (3) During starting or operation of burners, air monitoring failure signals appear;
- (4) As for burners equipped with switches for position verifying, the position of burners (or parts) is abnormal through verification during starting or operation,;
- (5) Items for control relevant to the heating device, such as pressure, water level and temperature etc. exceed limit.

For (2) of this article, if the rated oil level of oil burner is less than or equal to 30kg/h or if the fuel oil shut-off time after the flame extinguishment and before re-ignition doesn't exceed 1s, the burner may be re-ignited.

In addition to conditions from (1) to (5) of this article, the gas burner must also cut off the fuel supply in safety time and the system must be interlocked safely if the gas pressure is less than the set value during starting or operation of such burner.

Article 27 For multi-stage or continuous control gas burner with the air flow and gas flow changing asynchronously, the air and gas shall be such controlled to meet any of the following requirements:

- (1) Air shall be first adjusted if the flame is turned on and the gas first if the flame is turned down;

Chapter 4 Installation and System

Article 33 The burner must be installed by professional personnel in strict accordance with technical documents provided by the manufacturing organization. The external wiring must be constructed in strict accordance with the wiring diagram provided by the manufacturing organization.

Article 34 The burner and its parts shall be transported and installed steadily to avoid impact and crash. Each part of the burner shall be installed and fixed to the proper position in correct method, and able to maintain at the original position after being dismantled and re-assembled.

Article 35 The oil pump device (including oil pump, filter, motor and pressure control valve) and its fuel oil pipeline shall be provided with the following safety measures:

- (1) The oil supply amount of the oil pump shall meet the demand for maximum output thermal power of the burner and the oil pressure shall be convenient and reliable to control; if the oil pump and the fan device are at the same transmission shaft, they shall be convenient for installation and dismantlement;
- (2) The heavy oil heater shall be equipped with automatic temperature control device and high and low oil temperature interlocking protection devices to ensure the heavy oil reaches the atomizing viscosity required for the burner nozzle; if the heavy oil is heated through steaming, the pipeline section leading the steam out must be provided with thermal insulation measures to avoid scalding;
- (3) The burner and the fixed oil supply line should be connected with stiff pipe; if the flexible pipe made of non-metallic materials is adopted, it shall be wrapped with metallic materials and be as short as possible, and its bending radius shall be the minimum one for stiff pipe connection and meet the requirements for pressure withstand of the fuel oil pipeline.

Article 36 The gas burner and the gas pipeline should be connected with stiff pipe; if the flexible pipe made of non-metallic materials is adopted, it shall meet the requirements for pressure withstand of gas pipeline.

Article 37 Sealing gaskets made of thermal insulation materials shall be provided between the mounting flange of burner and that of heating device, and such sealing gasket shall not be less than 5mm in thickness and be possessed of adequate intensity.

Chapter 5 Operation and Maintenance

Article 43 Under the supply of specified fuel, the burner shall be able to operate normally within the operating range provided by the manufacturing organization.

Article 44 At the starting of the burner, the continuous ignition times shall not exceed 2, and reasons shall be found out at the failure of ignition and the burner shall be re-started after being adjusted properly.

Article 45 The flame stability shall conform to the following requirements:

- (1) The flame root at the burner outlet shall not flutter; for the oil burner, black grain flow shall not appear around its flame within the adjustable load;
- (2) The burner shall be able to combust continuously and safely under rated voltage, specified fuel and fixed output thermal power;
- (3) If the oil burner operates under the decline of the oil pressure, the fuel oil shall not spray columnar-like;
- (4) In the operation of the gas burner, the pressure of gas flowing in the burner shall fluctuate within the range not exceeding $\pm 5\%$ of the specified value.

Article 46 If the burner operates under rated load, the excess air coefficient shall be less than 1.2, and 1.5 if it operates under minimum load.

Article 47 If the oil burner operates steadily under normal operating condition, the combustion product shall be such discharged to meet the following requirements:

- (1) The CO content shall not be greater than 125mg/m^3 ;
- (2) The NO_x content shall not be greater than 400mg/m^3 ;
- (3) The smoke dust content shall not be greater than 50mg/m^3 ;
- (4) The flue gas blackness shall not be greater than Ringelmann Level I.

Article 48 If the gas burner operates steadily under normal operating condition, the combustion product shall be such discharged to meet the following requirements:

- (1) The CO content shall not be greater than 95mg/m^3 ;
- (2) The NO_x content shall not be greater than 200mg/m^3 ;
- (3) The smoke dust content shall not be greater than 50mg/m^3 ;
- (4) The flue gas blackness shall not be greater than Ringelmann Level I.

Chapter 6 Technical Documents and Nameplates

Article 54 At the delivery of burner products, the following technical documents for production (expressed in Chinese or English and adopting international units) shall at least be accompanied:

- (1) Diagrams for product outline and installation dimension;
- (2) Electrical wiring diagram;
- (3) Product instruction;
- (4) Product conformity certificate;
- (5) Product type test certificate or certificate for conformity through random inspection (hard copy);
- (6) Product packing list.

Article 55 The product instruction shall include the following contents:

- (1) Product structure and working principle;
- (2) Product performance description (including operating range); for the burner used for heating device, the burner manufacturing organization shall also provide the burner working curve in accordance with different requirements of the heating device;
- (3) Installation requirements;
- (4) Detailed description of operating methods;
- (5) Maintenance description;
- (6) Warnings and precautions.

Article 56 One nameplate shall be fixed at the striking position of the burner to indicate the following contents (expressed in Chinese or English and adopting international units):

- (1) Product model;
- (2) Production code number;
- (3) Output thermal power range of the burner;
- (4) Applicable fuel band;

Appendix D

Terms

D1 Dual fuel burner

The burner capable of simultaneously or independently burning oil and gas.

D2 Single-stage burner

The burner of which the fuel consumption is fixed to the set value and is not adjustable.

D3 Two-stage (multi-stage) control

The mode to control the output thermal power of the burner with the stepping variation of fuel consumption and combustion air amount under the normal operation of the burner.

D4 Continuous control

The mode to control the output thermal power of the burner with the continuous and smooth variation of fuel consumption and combustion air amount under the normal operation of the burner.

D5 Output thermal power

The heat released from the burner in unit-time due to combustion under certain backpressure.

Note: For the oil burner, its output thermal power may also generally be expressed with the fuel consumption of the burner in unit-time, with the unit of kg/h.

D6 Rated output thermal power

The rated heat released by the burner due to continuous and stable combustion with the designed fuel, which is indicated by the burner manufacturing organization.

D7 Maximum output thermal power

The maximum heat released by the burner due to combustion with the designed fuel, which is indicated by the burner manufacturing organization.

D8 Minimum output thermal power

The minimum heat released by the burner due to combustion with the designed fuel,

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