

Notice

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Boiler Safety Technical Supervision Administration Regulation

1 General Provisions

1.1 Purpose

With a view to strengthening safety supervision of boilers, preventing and minimizing accidents, guaranteeing life and property safety of the masses and promoting the economic development, this Regulation is formulated according to the relevant requirements of "Regulation on Safety Supervision of Special Equipment".

1.2 Applicable scope

This Regulation is applicable to the stationary pressure-bearing steam boiler (Note 1-1), pressure-bearing hot-water boiler, organic heat transfer material boiler as well as flue boiler and flue-shell composite waste heat boiler, both of which take the waste heat utilization as the fundamental purpose.

Note 1-1: The stationary boiler means that the boiler is fixed during the service period.

1.2.1 Boiler body

The integral that is composed of boiler drum, heating surface and the header & connecting pipeline, furnace, combustion equipment and air preheater (including flue and air duct), structure (including platform and staircase), furnace wall and slag removal equipment.

1.2.2 Boiler external piping

(1) Utility boiler, including main feed water pipeline, main steam pipe and reheat steam pipe;

(2) Boilers beyond utility boilers are divided into the boiler with steam (waster/oil) manifold (Note 1-2) and without it; the former includes the pressure pipe [including steam (waster/oil) manifold] in the first pass of circumferential weld connected between the boiler feed water (oil) pump & steam (waster/oil) manifold outlet and the external pipe while the latter includes the pressure pipe in the boiler feed water (oil) pump outlet and boiler main steam (water and oil) outlet valve.

Note 1-2: The steam (waster/oil) manifold shall meet the relevant requirements of the header in this Regulation.

1.2.3 Boiler safety accessories and instruments

Boiler safety accessories and instruments includes safety valve, pressure measuring device, water(liquid) level meter and indicator, temperature measuring device, blowdown and drainage device as well as safety protection devices and relevant instruments.

1.2.4 Boiler accessory and system

Boiler accessory and system includes the fuel preparation, steam-water and water treatment equipment and systems.

1.3 Non-applicable scope

This Regulation is not applicable to the following equipment:

- (1) Steam boiler with the normal design water volume less than 30L;
- (2) Hot-water boiler with the rated water-delivery pressure or rated thermal power less than 0.1MPa or 0.1MW respectively;
- (3) Heat exchanger required for equipment and process flow cooling.

1.4 Boiler equipment Level

1.4.1 Level A boiler

Level A boiler refers to that with p (gauge pressure, the same below, Note 1-3) greater than or equal to 3.8MPa, including:

- (1) Supercritical boiler, $p \geq 22.1\text{MPa}$;
- (2) Supercritical boiler, $16.7\text{MPa} \leq p < 22.1\text{MPa}$;
- (3) Superhigh pressure boiler, $13.7\text{MPa} \leq p < 16.7\text{MPa}$;
- (4) High pressure boiler, $9.8\text{MPa} \leq p < 13.7\text{MPa}$;
- (5) Sub-high-pressure boiler, $5.3\text{MPa} \leq p < 9.8\text{MPa}$;
- (6) Medium pressure boiler, $3.8\text{MPa} \leq p < 5.3\text{MPa}$.

1.4.2 Level B boiler

- (1) Steam boiler, $0.8\text{MPa} < p < 3.8\text{MPa}$;
- (2) Hot-water boiler, $p < 3.8\text{MPa}$ and $t \geq 120^\circ\text{C}$ (t is the rated outlet water temperature, the same below);
- (3) Gas-phase organic heat transfer material boiler, $Q > 0.7\text{MW}$ (Q is the rated thermal power, the same below); liquid-phase organic heat transfer material boiler, $Q > 4.2\text{MW}$.

1.4.3 Level C boiler

- (1) Steam boiler, $p \leq 0.8\text{MPa}$ and $V > 50\text{L}$ (V is the normal design water volume, the same below);
- (2) Hot-water boiler, $p < 3.8\text{MPa}$ and $t < 120^\circ\text{C}$;
- (3) Gas-phase organic heat transfer material boiler, $0.1\text{MW} < Q \leq 0.7\text{MW}$; liquid-phase organic heat transfer material boiler, $0.1\text{MW} < Q \leq 4.2\text{MW}$.

1.4.4 Level D boiler

- (1) Steam boiler, $p \leq 0.8\text{MPa}$ and $30\text{L} \leq V \leq 50\text{L}$;
- (2) Multifunctional boiler (steam and hot water) (Note 1-4), $p \leq 0.04\text{MPa}$ and $D \leq 0.5\text{ t/h}$ (D is the nominal capacity, the same below);

- (3) Hot-water boiler with only tap water pressurization and $t \leq 95^{\circ}\text{C}$;
- (4) Gas-phase or liquid-phase organic heat transfer material boiler, $Q \leq 0.1\text{MW}$.

Note 1-3: p is the rated working pressure of the boiler; for the steam boiler, it represents the rated steam pressure; for the hot-water boiler, it represents the rated water-delivery pressure; for the organic heat transfer material boiler, the represents the rated outlet pressure.

Note 1-4: Other multifunctional boilers (steam and hot water) respectively belong to the above boilers at all levels according to the outlet steam conditions and nominal capacity.

1.5 Manufacturing and service of imported and exported boilers

(1) Foreign boilers that are used in China shall meet requirements of this Regulation; in case of any inconsistency with those specified in this Regulation, consent from the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (hereinafter referred to as "AQSIQ") shall be obtained in advance.

(2) Domestic boilers that are used in overseas shall be implemented according to the technical regulation, standard and management requirements stipulated by the Parties in the Contract.

1.6 Treatment in particular case:

If units concerned fail to adopt new structure, process, material and technology (including introducing foreign technology and manufacturing according to foreign standards) according to this Regulation, relevant technical information shall be submitted to the Special Equipment Safety Technology Committee, AQSIQ for review and may be put into trial production and service after getting the approval of the AQSIQ.

1.7 Supervision and administration

(1) Boiler design, manufacturing, installation (including commissioning), service, inspection, alteration and repair shall be implemented according to the rules of this Regulation;

(2) Boiler and the system energy efficiency shall meet requirements of laws and regulations, technical codes and corresponding standards with regard to energy conservation;

(3) Boiler manufacturing, installation (including commissioning), service, alteration, repair and inspection unit shall timely fill in and report the information according to informatization requirements;

(4) The AQSIQ and the local quality and technical supervision departments (hereinafter referred to as "quality supervision department") are in charge of the safety supervision of the boiler and this Regulation.

1.8 Relationship with technical standards and management systems

This Regulation specifies the basic safety requirements of boilers as well as the relevant technical standards and management systems, which shall not be lower than those specified in this Regulation.

1.9 Description for relationship between chapters

Special requirements for the hot-water boiler, organic heat transfer material boiler, cast-iron boiler and Level D boiler are implemented respectively according to Chapter 10-13 of this Regulation and adopted preferentially.

2 Materials

2.1 Basic requirements

Metal material, bearing member material and the welding material of boiler pressure parts shall meet requirements of corresponding national and professional standards; the metal material and the welding material of the pressure parts under service conditions shall be provided with adequate strength, plasticity, toughness as well as good anti-fatigue performance and corrosion resistance.

2.2 Performance requirements

- (1) Killed steel shall be adopted for the boiler pressure parts and the bearing member welded with pressure parts;
- (2) Charpy impact absorbed energy (KV_2) under ambient temperature of steels for boiler pressure parts shall be greater than or equal to 27J;
- (3) Percentage elongation after fracture (A) under ambient temperature of steel plates for boiler pressure parts shall be greater than or equal to 18%.

2.3 Material selection

Steel plates, steel tube, forgings, steel castings, iron castings, fasteners, tension braces and welding materials for the boiler pressure parts shall be selected according to those specified in this article.

2.3.1 Material of steel plate for the boiler

The material of steel plate for the boiler is detailed in Table 2-1.

Table 2-1 Material of Steel Plate for the Boiler

Steel type	Designation	Serial numbers of standards	Applicable scope	
			Working pressure (MPa)	Wall temperature (°C)
Carbon steel	Q235B Q235C Q235D	GB/T 3274	≤1.6	≤300
	15,20	GB/T 711		≤350
	Q245R	GB 713	≤5.3 (Note 2-2)	≤430
Alloy steel	Q345R	GB 713		≤430
	15CrMoR	GB 713	Unlimited	≤520
	12Cr1MoVR	GB 713	Unlimited	≤565
	13MnNiMoR	GB 713	Unlimited	≤400

Note 2-1: Names of the standards for the materials listed in Table 2-1 are as follows: "Hot-Rolled Plates and Strips of Carbon Structural Steels and High Strength Low Alloy Structural Steels" (GB/T 3274), "Hot-Rolled Quality Carbon Structural Steel Plates Sheets and Wide Strips" (GB/T 711) and "Steel Plates For Boiler and Pressure Vessels" (GB 713).

Note 2-2: Where the drum (shell) free from radiant heat is manufactured, the working pressure will be unlimited.

Note 2-3: Where materials such as 18MnMoNbR, 14Cr 1MoR and Cr 2Mo 1R listed in GB 713 are used for the boiler steel plate, the applicable scope may be selected according to the relevant requirements of "Pressure Vessels" (GB 150).

2.3.2 Material of steel tube for the boiler

The material of steel tube for the boiler is detailed in Table 2-2.

Table 2-2 Material of Steel Tube for the Boiler

Steel type	Designation	Serial numbers of standards	Applicable scope		
			Usage	Working pressure (MPa)	Wall temperature (°C) (Note 2-5)
Carbon steel	Q235B	GB/T 3091	Hot water pipeline	≤1.6	≤100
	L210	GB/T 9711	Hot water pipeline	≤2.5	—
	10,20	GB/T 8163	Heating surface pipe	≤1.6	≤350
			Header and piping		≤350
		YB 4102	Heating surface pipe	≤5.3	≤300
			Header and piping		≤300
		GB 3087	Heating surface pipe	≤5.3	≤460
			Header and piping		≤430
Carbon steel	20G	GB 5310	Heating surface pipe	Unlimited	≤460
			Header and piping		≤430
	20MnG,25MnG	GB 5310	Heating surface pipe	Unlimited	≤460
			Header and piping		≤430
Alloy steel	15Ni1MnMoNbCu	GB 5310	Header and piping	Unlimited	≤450
	15MoG,20MoG	GB 5310	Heating surface pipe	Unlimited	≤480
	12CrMoG,15CrMoG	GB 5310	Heating surface pipe	Unlimited	≤560
	15Ni1MnMoNbCu	GB 5310	Header and piping	Unlimited	≤450
	15MoG,20MoG	GB 5310	Heating surface pipe	Unlimited	≤480
	12CrMoG,15CrMoG	GB 5310	Heating surface pipe	Unlimited	≤560
			Header and piping	Unlimited	≤550
	12Cr1MoVG	GB 5310	Heating surface pipe	Unlimited	≤580
			Header and piping	Unlimited	≤565
	12Cr2MoG	GB 5310	Heating surface pipe	Unlimited	≤600*
			Header and piping	Unlimited	≤575
	12Cr2MoWVTiB	GB 5310	Heating surface pipe	Unlimited	≤600*
	12Cr3MoVSiTiB		Heating surface pipe	Unlimited	≤600*
	07Cr2MoW2VNbB	GB 5310	Heating surface pipe	Unlimited	≤600*
	10Cr9Mo1VNbN	GB 5310	Heating surface pipe	Unlimited	≤650*
			Header and piping	Unlimited	≤620
	10Cr9MoW2VNbBN	GB 5310	Heating surface pipe	Unlimited	≤650*
			Header and piping	Unlimited	≤630
	07Cr19Ni10	GB 5310	Heating surface pipe	Unlimited	≤670*
	10Cr18Ni9NbCu3BN	GB 5310	Heating surface pipe	Unlimited	≤705*
	07Cr25Ni21NbN	GB 5310	Heating surface pipe	Unlimited	≤730*
	07Cr19Ni11Ti	GB 5310	Heating surface pipe	Unlimited	≤670*
	07Cr18Ni11Nb	GB 5310	Heating surface pipe	Unlimited	≤670*
	08Cr18Ni11NbFG	GB 5310	Heating surface pipe	Unlimited	≤700*

Note 2-4: Names of standards for materials listed in Table 2-2 are as follows: "Welded Steel Pipes for Low Pressure Liquid Delivery" (GB/T 3091), Petroleum and Natural Gas Industries - Steel Pipe for Pipeline Transportation Systems (GB/T 9711), "Seamless Steel Tubes for Liquid Service" (GB/T 8163), "Welded Steel Tubes for Low and Medium Pressure Boiler" (YB 4102), "Seamless Steel Tubes for Low and Medium Pressure" (GB 3087) and "Seamless Steel

Tubes and Pipes for High Pressure Boiler" (GB 5310).

Note 2-5: (1) The wall temperature marked with “*” refers to the external wall temperature of the pipe on the side of flue gas while other wall temperatures refers to the calculated wall temperatures of boilers;

(2) During the design and material selection for the supercritical boiler or above, full consideration shall be given to the oxidation corrosion by the steam in the inner wall.

2.3.3 Material of forgings for the boiler

The material of forgings for the boiler is detailed in Table 2-3.

Table 2-3 Material of Forgings for the Boiler

Steel type	Designation	Serial numbers of standards	Applicable scope	
			Working pressure (MPa)	Wall temperature (°C)
Carbon steel	20,25	JB/T 9626	≤5.3 (Note 2-7)	≤430
Alloy steel	12CrMo		Unlimited	≤550
	15CrMo			≤550
	12Cr1MoV			≤565

Note 2-6: Name of the standard for the material listed in Table 2-3 is as: "Specification for Boiler Forging" (JB/9626).

Note 2-7: The working pressure of the forgings in no contact with the flame is unlimited.

Note 2-8: For boiler forgings with the working pressure less than or equal to 2.5MPa and wall temperature less than or equal to 350°C, Q235 may be adopted for the fabrication.

Note 2-9: Where materials in "Carbon and Low-alloy Steel Forgings for Pressure Vessels" (NB/T 47008/JB/T 4726) not listed in Table 2-3 are used for the boiler forgings, the selection of the applicable scope may be implemented by reference to the relevant requirements of GB 150.

2.3.4 Material of steel castings for the boiler

The material of steel castings for the boiler is detailed in Table 2-4.

Table 2-4 Material of Steel Castings for the Boiler

Steel type	Designation	Serial numbers of standards	Applicable scope	
			Working pressure (MPa)	Wall temperature (°C)
Carbon steel	ZG200-400	JB/T 9625	≤5.3	≤430
	ZG230-450		Unlimited	≤430
Alloy steel	ZG20CrMo			≤510
	ZG20CrMoV			≤540
	ZG15Cr1Mo1V			≤570

Note 2-10: Name of the standard for the material listed in Table 2-4 is as: "Specification for Pressure Retaining Casting of Boiler Pipe Fittings" (JB/T 9625).

2.3.5 Material of iron castings for the boiler

The material of iron castings for the boiler is detailed in Table 2-5.

Table 2-5 Material of Iron Castings for the Boiler

Iron Casting Type	Designation	Serial numbers of standards	Applicable scope		
			Nominal diameter of accessories, DN (mm)	Working pressure (MPa)	Wall temperature (°C)
Grey cast iron	Not less than HT150	GB/T 9439	≤300	≤0.8	<230
		JB/T 2639	≤200	≤1.6	

Malleable cast iron	KTH300-06	GB/T 9440	≤100	≤1.6	<300
	KTH330-08				
	KTH350-10				
	KTH370-12				
Spheroidal graphite cast iron	QT400-18,Q	GB/T 1348	≤150	≤1.6	<300
	T450-10	JB/T 2637	≤100	≤2.5	

Note 2-11: Names of standards for materials listed in Table 2-5 are as follows: "Grey Iron Castings" (GB/T 9439), "Technical Specifications for Pressure-bearing Grey Iron Casting of Boiler" (JB/T 2639), "Malleable iron castings" (GB/T 9440), "Spheroidal Graphite Iron Castings" (GB/T 1348) and "Technical Specifications for Pressure-bearing Spheroidal Graphite Iron Casting of Boiler" (JB/T 2637)

2.3.6 Material of fasteners

The material of fasteners for the boiler is detailed in Table 2-6.

Table 2-6 Material of Fasteners

Steel type	Designation	Serial numbers of standards	Applicable scope	
			Working pressure (MPa)	Service temperature (°C)
Carbon steel	20,25	GB/T 699	Unlimited	≤350
	35			≤420
Alloy steel	30CrMo	GB/T 3077		≤500
	35CrMo	DL/T 439		≤500
	25Cr2MoVA			≤510
	25Cr2Mo1VA			≤550
	20Cr1Mo1VNbTiB			≤570
	20Cr1Mo1VTiB			≤570
	20Cr13,30Cr13	GB/T 1220		≤450
	12Cr18Ni9			≤610

Note 2-12: Names of standards for materials listed in Table 2-6 are as follows: "Quality Carbon Structural Steels" (GB/T 699), "Alloy Structure Steels" (GB/T 3077), "The Technical Guide for High-temperature Bolt of Fossil-Fired Power Plant" (DL/T 439) and "Stainless Steel Bars" (GB/T 1220).

Note 2-13: Where materials such as carbon steel and alloy steel studs and nuts listed in GB 150, that are not listed in Table 2-6 are used for the boiler fasteners, the selection of the applicable scope may be implemented by reference to the relevant requirements of GB 150.

Note 2-14: For fasteners for the boiler components with the working pressure less than or equal to 1.6MPa and wall temperature greater than or equal to 350°C, Q235 may be adopted for the fabrication.

2.3.7 Material of boiler tension braces

Steel plate for boilers shall be selected for the material of the boiler tension braces and they shall be selected according to requirements of "Hot-rolled Round Carbon Steel Bars for Standard Parts" (GB 715) and "Quality Carbon Structural Steels" (GB/T 699).

2.3.8 Welding material

Selection of welding material shall meet the requirements of "Technical Permission of Steel Welding Rod Purchasing for Pressure Vessels" (NB/T 47018.1~47018.7 /JB/T 4747).

2.3.9 Special requirements for material selection and processing

(1) Corresponding materials of steel tube for the boiler may be adopted for hot working and processing of pipe fittings (such as three-way, elbow and reducer union) and elements such as header head;

(2) Except various types of flanges, the outside diameter of the carbon steel hollow circular pipe fittings is less than or equal to 160mm; that of alloy steel hollow circular pipe fittings or pipe fittings with caps is less than or equal to 114mm. If the processed pipe fittings not only meet the requirements of the non-destructive testing, but also their longitudinal axes are parallel to the axes of the round steel, rolling or forged round steel may be adopted for the processing;

(3) Grey cast iron shall not be used to fabricate the blowdown valve and blowdown elbow;

(4) For boilers with the rated working pressure less than or equal to 1.6MPa and superheaters with the steam temperature less than or equal To 300℃, the malleable iron or the spheroidal graphite cast iron listed in Table 2-5 may be adopted for the fabrication of their blow-off valve and blowdown valve;

(5) For the square cast-iron economizer and elbow of the boiler with the rated working pressure less than or equal to 2.5MPa, grey cast iron with the designation not greater than or equal to HT 200 are allowed to be adopted; for the square cast-iron economizer and elbow of the boiler with the rated working pressure less than or equal to 1.6MPa, the grey cast iron with the designation greater than or equal to HT 150 are allowed to be adopted;

(6) Repair welding is forbidden for the iron castings for the pressure parts.

2.4 Material substitution

Substitute material of the boiler shall conform to the rules for material of this Regulation. The material substitution shall meet requirements of strength, structure and process and shall be approved by the technical division (including design and process department) of the material substitution unit.

2.5 Development of new material

Where new material not listed in this Regulation is adopted, the development unit of the material shall carry out systemically experimental investigation before trial production and the material shall pass the technical evaluation and approval according to the requirements of Section 1.6 in this Regulation. The evaluation shall cover chemical compositions, physical

properties, mechanical property, structure stability, high-temperature property, corrosion resistance and process property.

2.6 Materials with foreign designation

2.6.1 Materials with foreign designation are adopted for the boiler pressure parts.

(1) It shall be the designation of the material standard for the foreign boiler or designation of the material whose chemical composition, mechanical property and process property are similar to that of the domestic boiler material or the mature designation of the material for boiler;

(2) Acceptance inspection shall be carried out for the material according to the technical standards and technical provisions prescribed in the order contract;

(3) Welding procedure qualification and molding process test shall be carried out before the first use;

(4) Performance index specified in the technical standards or technical provisions for the material shall be adopted for the strength calculation.

2.6.2 Material with foreign designation manufactured by the material manufacturer

Manufacturing and acceptance shall be carried out for the material with foreign designation manufactured by the material manufacturer according to provisions of foreign standards for the material; and by comparison to the standards for the domestic boiler material, in case of any missing inspection item, inspection on the missing item shall be made up and they may be used only after it is deemed as acceptable; before the formal manufacturing, it shall pass the technical evaluation and approval according to the requirements of Section 1.6 in this Regulation.

2.7 Material quality certificate

(1) The manufacturer of the material shall provide the user with the original quality certificate according to corresponding material standard and provisions of the order contract; and shall make clear and solid hard stamp or other marks at the conspicuous location of the material. The material quality certificate items shall be complete and clear and the certificate shall be stamped with the quality inspection of the material manufacturer;

(2) Where the boiler material is not directly supplied by the material manufacturer, the Supplier shall provide the original material quality certificate or its copies and stamp its official stamp and signature or stamp of its manager;

(3) The using unit of the boiler material is responsible for the authenticity and consistency of the boiler material and the material quality certificate.

2.8 Material acceptance

The boiler manufacturing, installation, alteration and repair units shall carry out receive acceptance for the boiler material according to the relevant regulations and may use it after its qualified. The material could not be retested for physicochemical testing and corresponding non-destructive examination under any of the following conditions:

(1) The acceptance personnel of the material using unit shall carry out at the material manufacturer according to the procurement specifications and make a witness signature on the inspection report for confirmation;

(2) the carbon steel plates and tube for Level B boiler or below as well as carbon steel welding materials shall be provided with clear and complete physical marks and quality certificate in accordance with the requirements of Section 2.7 in this Regulation. In addition, that in the quality certificate shall be consistent with the physical object.

2.9 Material management

(1) The boiler manufacturing, installation, alteration and repair units shall establish a material preservation and service management system. The material for the boiler pressure parts shall be provided with marks; and the markings transplantation shall be made for easy identification before the material is cut off;;

(2) The using unit of the welding material shall establish a storage, drying, distribution, recovery and reuse management systems for the welding material.

3 Design

3.1 Basic requirements

The boiler design shall meet the requirements of safety, reliability and energy conservation. The unit granted with a boiler manufacturing license is responsible for the design quality of its manufactured boilers.

3.2 Design document appraisal

The design document of the boiler proper may be put into production after it is deemed as acceptable by the design document appraisal agency approved by the AQSIQ.

3.3 Strength calculation

3.3.1 Selection of safety factors

During the strength calculation, the minimum safety factor for determination of the allowable stress of the boiler pressure-bearing material is detailed in Table 3-1; and the determination for other design methods and safety factors of part materials shall meet requirements of relevant product standards.

Table 3-1 Safety Factors for Strength Calculation

Materials (plate, forging and tube)	Safety factors			
	Tensile strength at the ambient temperature, R_m	Yield strength at the design temperature, $R_{eL}^t (R_{p0.2}^t)$ (Note 3-1)	Limit average of endurance strength at the design temperature, R_D^t (Note 3-2)	Creep limit average at the design temperature (0.01% creep rate per 1000h), R_n^t
Carbon steel and low alloy steel	$n_b \geq 2.7$	$n_s \geq 1.5$	$n_d \geq 1.5$	$n_n \geq 1.0$
High alloy steel	$n_b \geq 2.7$	$n_s \geq 1.5$	$n_d \geq 1.5$	$n_n \geq 1.0$

Note 3-1: If $R_{p1.0}^t$ is permitted to be adopted in the product standard, the value $R_{p1.0}^t$ may be selected to calculate the allowable stress.

Note 3-2: R_D^t indicates the endurance strength limit for 1.0×10^5 h.

3.3.2 Strength calculation standards

The strength of the pressure parts for the boiler proper may be calculated and checked according to "Strength Calculation of Pressure Parts for Water tube Boilers" (GB/T 9222) or

"Strength Calculation of Pressure Parts for Shell Boiler" (GB/T 16508). Where test or other calculation methods is adopted to determine the strength of the boiler pressure parts, it shall be implemented according to the requirements of Section 1.6 in this Regulation.

Strength of Level A boiler piping may be calculated according to "Code for Design of Thermal Power Plant Steam/Water Piping" (DL/T 5054) while that of Level B or below boiler piping may be calculated according to "Design Code for Industrial Metallic Piping" (GB 50316).

3.4 Basic requirements for boiler structure

- (1) All pressure parts shall have adequate strength;
- (2) Structural form as well as arrangement of opening and weld of pressure parts shall avoid or minimize the combined stress and stress concentration to the greatest extent;
- (3) The boiler water circulation system shall be able to guarantee the reliability of the boiler water circulation within the variation range of the design load and reliable cooling of all the heating surfaces. When arrange the heating surface, the medium flow shall be rationally distributed to minimize the thermal deviation as much as possible;
- (4) Structure as well as the arrangement and combustion mode of the furnace and combustion equipment shall be corresponding with the designed fuel and be protected against furnace slagging or coking;
- (5) When the wall temperature of the element on the non-heating surface may exceed the allowable temperature of the material for the element, cooling or thermal insulation measures shall be taken;
- (6) Each part shall be able to expand freely to the design preset direction during the operation;
- (7) The bearing structure shall have adequate strength, rigidity, stability and anti-corrosion when it bears a design load;
- (8) Structure of the furnace, wall enclosure and flue shall have adequate load-carrying capacity;
- (9) The furnace wall shall have good thermal insulation and tightness;
- (10) It shall be easy for installation, running, operation, inspection, repair and cleaning of the internal and external.

3.5 Wall thickness and length of the drum (shell) and boiler furnace

3.5.1 Wall thickness of water tube boiler drum

The selected wall thickness of the drum shall be greater than or equal to 6mm.

3.5.2 Wall thickness and boiler furnace length of shell boiler

(1) Where the inside diameter of the shell is greater than 1000mm, the wall thickness selected for the shell drum shall be greater than or equal to 6mm; where the inside diameter of the shell is less than or equal to 1000mm, the wall thickness selected for the shell drum shall be greater than or equal to 4mm;

(2) The inside diameter of the shell boiler furnace shall be less than or equal to 1800mm and the selected wall thickness shall be between 8mm and 22mm (including 8mm and 22mm); where the inside diameter of the boiler furnace is less than or equal to 400mm, the selected wall thickness shall be greater than or equal to 6mm; the wall thickness of the reversal chamber drum of the horizontal internal combustion boiler shall be between 10mm and 35mm (including 10mm and 35mm);

(3) The calculated length of the plain furnace of the horizontal shell boiler shall be less than or equal to 2000mm; if the both ends of the boiler furnace is butt joint with the pipe plate edges, the calculated length of the plain boiler furnace may be amplified to 3000mm.

3.5.3 Drum and tube plate of expanded drum (shell)

The wall thickness selected for the drum and tube plate of the boiler expanded drum (shell) shall be greater than or equal to 12mm.

Expanding shall not be adopted for the tube with the outside diameter greater than 89mm.

3.6 Safe water level

(1) The lowest safe water level of the water tube boiler drum shall be able to guarantee reliable water supply of the downcomer;

(2) The lowest safe water level of the shell boiler shall be 100mm higher than the fire line; for the horizontal shell boiler with the inside diameter less than or equal to 1500mm, the lowest safe water level shall be 75 mm higher than the fire line;

(3) The minimum and maximum safe water level of the boiler shall be indicated on the drawing;

(4) The opening position of the direct reading water level gauge and water level control device shall guarantee the control range of the device includes the lowest and highest safe water levels.

3.7 Connection of main pressure parts

3.7.1 Basic requirements

(1) Full-penetration butt joint shall be adopted for main welds of the main pressure parts for the boiler [including longitudinal and circumferential welds of drum (shell), header, boiler furnace, reversal chamber and utility boiler start-up (steam-water) separator, centralized downcomer and steam-water pipe as well as butt welds of the head, tube sheet, boiler furnace top and water-leg ring.

(2) Splicing shall not be adopted for the staying components of the shell boiler.

3.7.2 Connection of T-shaped joint

For the horizontal internal combustion boiler with the rated working pressure less than or equal to 2.5MPa, once-through boiler and pressure units with the gas temperature in the service environment less than or equal to 600℃, butt connection of T-shaped joint, but not the lapping connection may be adopted under the following conditions:

(1) Full-penetration joint is adopted for the weld with the groove subject to machining;

(2) Plug-in structure shall be adopted for the connection of the tube sheet of shell and furnace with the drum of the horizontal internal combustion boiler;

(3) The weld thickness at the connecting place of the T-shaped joint is greater than or equal to the wall thickness of the tube sheet (cover plate) and seal weld shall be carried out on back of the weld where the seal weld is possible and argon arc welding shall be adopted with guaranteed weld penetration for the priming at the place where the seal weld is impossible;

(4) Ultrasonic testing shall be carried out for the weld at the connecting part of the T-shaped joint according to the relevant requirements of "Nondestructive Testing of Pressure Equipments" (NB/T 47013/JB/T 4730).

3.7.3 Connection of the tube joint and drum (shell), header and piping

For the connection between the tube joint and the drum (shell), the header and the piping, full-penetration joint shall be adopted under the following conditions:

(1) In strength calculation, where the opening strength reinforcement is necessary with tube joint;

(2) Where the outside diameter of the tube joint for the Level A high-pressure boiler or above is greater than 76mm;

(3) Tube joints of the centralized downcomer for the Level A boiler;

(4) The downcomer or its tube joint is connected with the header (except the downcomer with outside diameter less than or equal to 108 mm and plug-in structure is adopted)

3.7.4 Tube joint with small diameter

For level A boilers, where tube joints such as exhaust, drain and downturn tube as well as sampling tube are connected with the drum (shell), header and piping, tube joint with thick wall shall be adopted.

3.8 Arrangement of tube orifice

3.8.1 Expanded tube orifice

(1) The clear distance between the expanded tube orifices is greater than or equal to 19mm;

(2) The distance from the center of the expanded tube orifices to the weld edge and to the starting point of the tube sheet flanged portion shall be greater than or equal to $0.8d$ (d is the diameter of the tube orifice, mm), and greater than or equal to $0.5d+12\text{mm}$;

(3) The expanded tube orifices shall not be located at the longitudinal weld of the drum, nor on the circumferential weld; for the circumferential weld, if it is unavoidable for the structural design, the weld at 60mm around the tube orifice (if the diameter of the tube orifice is greater than 60mm, the orifice diameter shall be taken) shall be deemed as acceptable in the radiographic or ultrasonic testing and the weld shall be free from the slag inclusion at the edges of the tube orifice. After the internal and external surfaces of the weld at the orifice are planished and heat treatment is carried out for the whole pressure parts, the expanded tube orifices may be made at the circumferential weld.

3.8.2 Welded tube orifice

The tube orifice of the centralized downcomer shall not be located at the weld and other welded tube orifices also shall be kept clear of the weld and the heat affected zone. If it is unavoidable for the structural design, on condition that the weld within 60mm around the tube orifice (if the diameter of the tube orifice is greater than 60mm, the orifice diameter shall be taken) is deemed as acceptable in the radiographic or ultrasonic testing and is free from slag inclusion at the edges of the tube orifice; and that the tube joint is subject to the heat treatment for stress relief after welding, the welded tube orifice may be made at the weld or in the heat affected zone.

3.9 Arrangement of the weld

3.9.1 Adjacent main weld

The longitudinal welds of two adjacent shell rings at the drum (except that with unequal wall thickness), shell and boiler furnace as well as the butt welds at the head, tube plate, boiler furnace top or water-leg ring and the longitudinal weld at adjacent shell rings shall not be connected with each other. The distance between the center lines of the welds (arc length of the excircle) is at least three times as much as the thickness of the thicker steel plate and greater than or equal to 100mm.

3.9.2 Boiler heating surface pipe and the butt weld at the piping

3.9.2.1 Distance between center lines of the butt welds

The distance (L) between center lines of the butt welds at the boiler heating surface pipe (except the dissimilar steel joint) and the straight section of the piping shall meet the following requirements:

(1) The outside diameter shall be less than 159mm and L shall be greater than or equal to 2 times of the outside diameter;

(2) The outside diameter shall be greater than or equal to 159mm and L shall be greater than or equal to 300mm.

Where the boiler structure is difficult to meet the requirements of items (1) and (2) in this article, the heat affected zones of butt welds shall not be overlapped and L shall be greater than or equal to 50mm.

3.9.2.2 Position of butt weld

(1) The butt weld at the heating surface pipe and piping (except coil tube and molded pipe fittings) shall be located at the straight section of the pipe;

(2) The distance between the center line of the butt weld at the heating surface pipe and the external wall of the drum (shell) and header, starting point of the pipe bending and the edges of the pipe supports and hangers shall be at least 50mm; the distance shall be at least 70mm for Level A boilers and shall be greater than or equal to 100mm for piping.

3.9.3 Main welds at pressure parts

Main welds at the pressure parts and the neighboring areas shall be kept clear of the welded attachments. If impossible, the weld at the welded attachments may be penetrated through the main weld, but shall not be ended at the main weld and the neighboring areas.

3.10 Length of straight section at flanged element

Except the spherical head, where the butt welding is adopted for the flanged elements (such as head, tube sheet and boiler furnace top) and the cylindrical elements, a distance of certain straight section shall be provided with between the starting point of the flange and the center line of the weld. The length of straight section at flanged element shall meet those requirements specified in Table 3-2.

Table 3-2 Length of Straight Section at Flanged Element

Inside diameter of the flanged element (mm)	Length of the straight section (mm)
≤600	≥25
>600	≥38

3.11 Installation of sleeve

For any Level B steam boiler or above, where any connecting pipe (such as water supply pipe and desuperheating water pipe) that can cause partial thermal fatigue of the drum (shell) wall or header wall is routed through the drum (shell) wall or header wall, a sleeve shall be installed.

3.12 Periodic blowdown pipe

(1) The periodic blowdown pipe orifice for the boiler shall not be higher than the lowest surface of the inner wall of the drum or header;

(2) Where the orifice type of blowdown pipe is used for the periodic blowdown, the orifice shall be made on the lower blowdown pipe and close to the bottom of the cylindrical shell.

3.13 Emergency blow-off device

The drum of the utility boiler shall be equipped with the emergency blow-off device and the blow-off tube orifice shall be higher than the lowest safe water level.

3.14 Arrangement of water-steam sampler and backpurge system

The water-steam sampler and the backpurge system shall be arranged for the boiler according to the following conditions and representative position shall be selected for the arrangement of the sampling point during the boiler design:

(1) Water supply sampling point shall be arranged at the feedwater pump outlet of Level A once-through boiler;

(2) The water-steam sampler shall be arranged at the economizer inlet, drum, saturated steam outlet tube, superheater and reheater of Level A boiler;

(3) Generally, the backpurge system shall be arranged for the superheater of Level A boiler and the back flushing medium also may be led into through the drain pipeline at the front of the main stop valve;

(4) Boiler water sampler shall be arranged for Levels B and C boilers; if with requirements on the steam quality, steam sampler shall be arranged.

3.15 Expansion indicator

Expansion indicator shall be arranged at the drum and header of the Level A boiler. The expansion center determined according to the design of the suspending boiler proper shall be fixed.

3.16 Flat steel welded with the tube

The expansion factor of the flat steel welded with the tube in the membrane wall structures shall be close to that of the tube; the width of the flat steel shall be determined to ensure the temperature of boiler is less than or equal to the allowable temperature of the metal material during the operation and the weld structure shall ensure effective cooling of the flat steel.

3.17 Spray desuperheater

(1) The fixed mode between the header and the neck bush of the spray desuperheater as well as between the spray pipe and header shall be able to guarantee their relative expansion and avoid resonance;

(2) Structure and arrangement of the spray desuperheater shall be convenient for inspection and repair; an inspection hole with the inside diameter greater than or equal to

80mm shall be arranged and the position of the inspection hole shall be convenient for the endoscopy of the neck bush and spray pipe of the desuperheater.

3.18 Protection for the economizer at boiler start-up

Bypass waterway, recirculating pipe or other protection measures for the economizer at boiler start-up shall be provided for the boiler arranged with an economizer.

3.19 Protection for reheater

The utility boiler shall be installed with steam bypass or furnace outlet gas temperature monitoring devices so as to ensure the cooling of the reheater at the start-up and load rejection.

3.20 Soot blower and extinguishing device

Reliable soot blower and air preheater extinguishing device shall be arranged at the tail of the Level A boiler installed with an oil burner. Soot blowers shall be installed at the furnace and the convection pass arranged with superheater and reheater of the pulverized coal-fired boiler or coal water slurry fired boiler.

3.21 Drain device at the back-end flue

Reliable drain device shall be arranged at the back-end flue of the Level B and below gas and condensing boilers.

3.22 Explosion-proof door

Where the pulverized coal, oil or gas fired water tube boilers with the nominal capacity less than or equal to 75t/h are not arranged with automatic protection system for the furnace safety, the furnace and flue shall be arranged with explosion-proof door and the arrangement of the explosion-proof door shall not endanger the personnel safety.

3.23 Door opening

3.23.1 Arrangement and structure of door opening

(1) Quantity and position of the manhole, head opening, handhole, cleaning hole, inspection hole and the sight hole shall meet the requirements of the installation, inspection and repair, operation monitoring and cleaning;

(2) Where non-welding is adopted for the header handhole cover and ring, it shall avoid direct contact with the flame;

(3) The pressurized combustion boiler, furnace wall, flue and door openings at various parts shall be provided with reliable seal and the fire-viewing hole shall be installed with interlock device for preventing flame from spurting out;

(4) Full-penetration structure shall be adopted for the connection of the manhole ring, head opening ring as well as drum and head (tube sheet) for the boiler pressure parts while enclosed structure shall be adopted for the manhole cover, head opening cover, handhole cover, cleaning hole cover and inspection hole cover; for Level B boiler and below, the flanged

structure but no thread connection can be adopted for the hole cover of the pressure part; the manhole door in the furnace wall shall be installed with solid bolt and the cover of the monitoring hole on the furnace wall shall be ensured cannot be burst open by the flue gas;

(5) For the watertube boiler with the inside diameter of the drum greater than or equal to 800mm and the shell boiler with the inside diameter of the shell greater than 1000mm, the manhole shall be made at the drum or head (tube sheet). Where personnel fails to access to the boiler due to structural constraint, only head opening may be made; for the boiler equipped with smoke tube in the shell, the arrangement of the manhole and head opening shall also meet the inspection and repair demands of the upper and lower shells; for the watertube boiler with the inside diameter of the drum less than 800mm and the shell boiler with the inside diameter of the shell of 800mm~1000mm, at least one head opening shall be made at the drum or head (tube sheet);

(6) Quantity of handholes made at the lower vertical shell boiler shall meet the requirements of cleaning and inspection and shall be greater than or equal to 3.

3.23.2 Size of the door opening (Note 3-3)

(1) Size of the elliptical manhole at the boiler pressure part shall be greater than or equal to 280mm×380mm and the diameter of the round manhole shall be greater than or equal to 380mm; width of the minimum seal plane for the manhole ring is 19mm and the total clearance between the manhole cover shoulder and the manhole ring shall be less than or equal to 3mm (it is less than or equal to 1.5mm along points on the circle); in addition, the recess depth shall be able to completely accommodate the sealing gasket;

(2) Size of the elliptical head opening at the boiler pressure part shall be greater than or equal to 220mm×320mm and its neck or ring height shall be less than or equal to 100mm and the width of the minimum seal plane for the head opening ring is 15mm;

(3) Size of the handhole stub axis at the boiler pressure part shall be greater than or equal to 80mm; the neck or ring height shall be less than or equal to 65mm and the width of the minimum seal plane for the handhole ring shall be 6 mm;

(4) The inside diameter of the cleaning hole at the boiler pressure part(component) shall be greater than or equal to 50mm and the neck height shall be less than or equal to 50mm;

(5) Generally, size of the elliptical manhole in the furnace wall shall be greater than or equal to 400mm×450mm, diameter of the round manhole shall be greater than or equal to 450mm and size of the rectangular door opening shall be greater than or equal to 300mm×400mm.

Note 3-3: if the neck or ring height is greater than those specified in Article 3.23.2 due to structure, the size of the hole shall be properly enlarged.

3.24 Boiler steel structure

3.24.1 Basic requirements

Design of the supported and suspended boiler steel structure shall meet requirements of "Specification for Design of Boiler Steel Structures" (GB/T 22395).

3.24.2 Platform and staircase

The boiler with the height from the standing ground of the operation personnel to the ground (or operation floor) exceeds 2000mm shall be installed with facilities such as platform, staircase and guardrail. The platform and staircase of the boiler shall meet the following requirements:

(1) The arrangement of the staircase and platform shall be able to guarantee that the operation personnel can pass without a hitch to the place where frequent operations and inspections are required;

(2) Height of the staircase and platform as well as the banister, handrail and foot-stopping plate arranged around the boiler top in need of operation and inspection shall meet the relevant requirements;

(3) The inclination angle of the staircase shall be generally $45^{\circ} \sim 50^{\circ}$. If arrangement is difficult, the inclination angle may be properly enlarged;

(4) The vertical height from the platform in front of the water gauge to the middle of water gauge shall be 1000mm ~1500mm.

3.25 Special requirements for once-through utility boiler

(1) Once-through utility boiler shall be arranged with start-up system and the capacity shall be corresponding with the minimum once-through load of the boiler.

(2) Where the external start-up (steam-water) separator is adopted to start the system of the once-through utility boiler, the working pressure of the isolating valve shall be considered according to the design pressure of the maximum continuous load; the strength of the start-up (steam-water) separator shall be designed and calculated according to the design parameter for the minimum once-through load of the boiler. Where the internal start-up (steam-water) separator is adopted to start the system, strength of all components shall be calculated according to the design parameter for the maximum continuous load of the boiler;

(3) The drain capacity of the start-up system of the once-through utility boiler shall satisfy the maximum drain flow in case of steam-water expansion under any start-up modes of the boiler;

(4) The mass flow rate of the working medium in the water wall tube of the once-through utility boiler, under any operating condition, shall be greater than the minimum critical mass flow speed under the operating condition.

4 Manufacturing

4.1 Basic requirements

(1) The boiler manufacturer may engage in the manufacturing of boilers within the authorized range after obtaining a manufacturing license for the special equipment of corresponding product and be responsible for the product performance and quality of the delivered boiler;

(2) After the boiler material preparation or groove processing and machining & forming of pressure parts, it shall be free from injurious defect and cold forming shall avoid producing cold hardening and thus causing brittle failure or cracking while the hot forming shall avoid injurious defect due to over-high or over-low forming temperature.

4.2 Expanding

4.2.1 Expanding procedure

The expanding construction unit shall formulate the expanding procedure expanding procedure specification according to the design drawing of the boiler and results of trial expansion. Before expanding, trial expansion shall be carried out. During the trial expansion, reasonable expanding rate shall be determined. Where the boiler in need of expanding at the installation site is delivered, the boiler manufacturer shall provide appropriate quantity of expanding specimen with the same designation.

4.2.2 Material of expanding tube

Material with the hardness lower than that of the tube sheet (drum) shall be selected for the material of expanding tube. If the hardness on tube ends is greater than that of the tube sheet (drum), annealing treatment shall be carried out. In addition, during the annealing for tube ends, coal shall not be used as fuel for direct heating and the annealing length at the tube ends shall be greater than or equal to 100mm.

4.2.3 Calculation method for the expanding rate

4.2.3.1 Inside diameter control method

Where the inside diameter control method is adopted, the expanding rate generally shall be controlled within the range of 1.0%~2.1% and the expanding rate shall be calculated according to Formula (4-1).

$$H_n = \left[\frac{d \pm \frac{\Delta t}{d}}{-1} - 1 \right] \times 100\% \quad (4-1)$$

Where,

H_n - the expanding rate by the inside diameter control method, %;

d_1 - the measured inside diameter of the tube after expanding, mm;

t - the measured wall thickness of the tube before expanding, mm;

d - the measured diameter of the tube orifice before expanding, mm.

4.2.3.2 Outside diameter control method

For the watertube boiler, where the outside diameter control method is adopted, the expanding rate generally shall be controlled within the range of 1.0%~1.8% and the expanding rate shall be calculated according to Formula (4-2).

$$H_w = \frac{D - d}{c} \times 100\% \quad (4-2)$$

Where,

H_w - the expanding efficiency by the outside diameter control method, %;

D - the measured outside diameter of the tube close to the external drum wall after expanding, mm;

d - the measured diameter of the tube orifice before expanding, mm.

4.2.3.3 Control method for the reduction ratio of the tube wall thickness

(1) Torque setting shall be carried out for the combination of the tube and wall thickness in different specification during the trial expansion before expanding;

(2) The torque setting is realized through the test tube orifice expanded into the test plate; after the test tube is expanded, open the test plate and take the test tube to measure the reduction of the tube wall and then calculate the reduction ratio of the tube wall; the reduction ratio of the tube wall thickness shall be generally controlled within the range of 10%~12%; after the torque is set, the torque shall be recorded and applied in construction; the reduction ratio of the expanded tube wall thickness shall be calculated according to Formula (4-3);

$$\text{Reduction of wall thickness} = \frac{\text{Tube wall thickness before expanding} - \text{Tube wall thickness after expanding}}{\text{Tube wall thickness before expanding}} \times 100\% \quad (4-3)$$

(3) In order to guarantee normal operation of the expanding equipment, the operation personnel shall carry out once trial expansion before each shift during the construction and the inspection department shall verify whether the construction torque is completely the same as the originally set torque.

4.2.4 Expanding quality

(1) The protrusion of the expanding tube end shall be 6mm ~12mm; the flaring on the tube end shall form an angle of 12°~15° with the center line of the tube; the starting point of the flaring shall be flushed with the tube plate (drum) surface;

(2) For the shell boiler, 90° flanging shall be carried out for the smoke tube end in direct contact with the flame (the temperature of above 800℃). The flanged tube end shall be closely contacted with the tube plate and the maximum clearance shall be less than or equal to 0.4mm and the length with the clearance greater than 0.05mm shall not exceed 20% the circumference of the tube;

(3) After the expanding, defects such as peeling, wrinkle, cut and deflection shall not exist on the tube end; in the expanding process, the expanding quality of the expanding mouth shall be inspected at any time so as to timely discover and eliminate any defect.

4.2.5 Expanding record

The expanding construction unit shall make the expanding record well according to the actual inspection and measurement results for the convince of the calculation of the expanding rate and inspection of the expanding tube quality.

4.2.6 Hydraulic test after expanding

After the completion of the expanding, hydraulic test shall be carried out to check the tightness of the expanding mouth.

4.3 Welding

4.3.1 Management of welding operator

(1) The welding operator of the boiler pressure parts (hereinafter referred to as "the welder" shall be assessed according to the requirements of relevant safety technical codes such as "Examination Rules for Welding Operators of Special Equipment" (TSG Z6002) and may engage in the welding work within the scope of the qualified item within the effective period after obtaining the "Special Equipment Operator Certificate"

(2) The welder shall carry out the welding according to the welding procedure and make the welding record well;

(3) The steel seal of the welder identification shall be stamped near the weld of the boiler pressure part; for the material that can't be stamped with a steel seal, detailed record including the welder identification shall be made;

(4) The manufacturer shall create technical files for the welder, and check and evaluate the actual welding procedure parameters and weld quality as well as the welder's conformity of the procedure discipline.

4.3.2 Welding procedure qualification

The welding procedure qualification shall meet not only the requirements of "Welding Procedure Qualification for Pressure Equipment" (NB/T 47014/ JB/T 4708), but also the requirements of this article.

4.3.2.1 Scope of the welding procedure qualification

Before welding the boiler, the welding unit shall carry out the welding procedure qualification for the following welded joints:

(1) Butt welded joint between pressure parts;

(2) Required full-penetration T-shaped or angle joint between pressure parts or the pressure part and the load-bearing non-pressure parts.

4.3.2.2 Additional requirements for the test coupon (specimen)

(1) For the longitudinal welds of the Level A boiler drum and the header components, where the plate thickness is greater than 20mm but less than or equal to 70mm, a full-weld metal tensile specimen shall be cut from the welding procedure qualification specimen (test plate) along the longitudinal weld; where the plate thickness is greater than 70mm, 2 full weld metal tensile specimens shall be taken; the test methods and sampling positions shall be in accordance with the "Tensile Test Methods on Weld and Deposited Metal" (GB/T 2652);

(2) For the Level A boiler drum, header components of alloy steel material and piping, if the double welded wall thickness is greater than or equal to 12mm (the single welded wall thickness is greater than or equal to 16mm), an impact test under the ambient temperature shall be carried out for the deposited metal of the weld and Charpy V-notch in the heat affected zone;

(3) Where the material of the welding specimen is alloy steel, during the welding procedure qualification, metallographic inspection shall be carried out for the butt weld of Level A boiler drum as well as the header components with working pressure greater than or equal to 9.8MPa or wall temperature greater than 450℃ and piping, and the fillet weld of tube joint at Level A boiler drum and header components.

4.3.2.3 Additional requirements for the assessment of test results

(1) Test results of the full weld metal tensile specimen shall fulfill with the specified tensile strength (R_m) or yield strength ($R_{p0.2}$) of the base material;

(2) In case of any crack, loosening, overburning and abnormal structure that exceeds the limit discovered in the metallographic inspection, it shall be deemed as unacceptable; for the specimen which is unacceptable only due to the abnormal structure that exceeds the limit, once heating treatment is allowable for the inspected specimen and then double specimen shall be taken for the re-examination(after the qualification, the re-examination of mechanical property is still required) and the metallographic examination is acceptable only after all re-examined specimens are acceptable.

4.3.2.4 Welding procedure qualification document

(1) The welding unit shall, according to the product welding requirements and welding procedure qualification standard, compile the pre-welding procedure specification (pWPS) for assessment, and form a welding procedure qualification report (PQR) after the pWPS is evaluated as acceptable in the welding procedure qualification, then it may carry out the welding only after formulating the welding procedure specification (WPS);

(2) After completion of the welding procedure qualification, the welding procedure qualification report and welding procedure specification shall be reviewed by the responsible welding engineer and approved by the technical principal of the manufacturer, and finally archived in the technical files which shall be kept as long as the expiry date of the welding procedure qualification. The welding procedure qualification specimen shall be at least kept for 5 years.

4.3.3 Welding

4.3.3.1 Basic requirements

(1) The welding for the pressure part shall be carried out at places free from wind, rain and snow; where gas metal arc welding (GMAW) is adopted, external airflow interference shall be avoided; where the ambient temperature is lower than 0°C, preheating measures shall be taken;

(2) Forced alignment shall not be made for the assembling of welded parts. The welding may be carried out only after the assembling quality of the welded parts and the quality of the tack welding meet the requirements of the procedure documents.

4.3.3.2 Argon arc welding priming

Argon arc welding priming shall be adopted for the following locations:

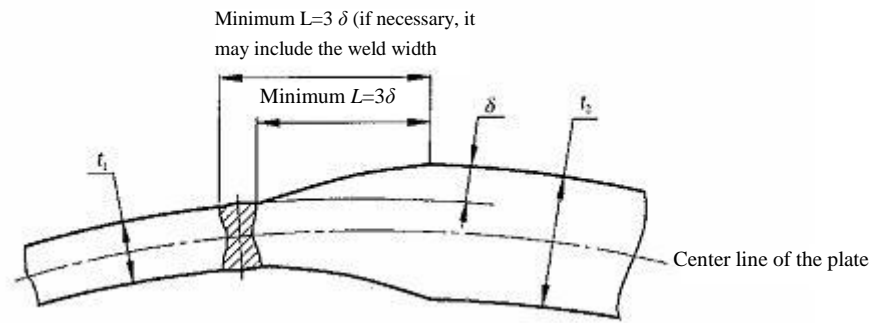
- (1) Connection welds of the vertical shell boiler water-leg ring and shell;
- (2) Butt welds of the organic heat transfer material boiler tube and piping;
- (3) Butt weld of steam (water) injection boiler tube.

For Level A high-pressure boiler or above, argon arc welding priming shall be adopted for the composite welds of the tube joints on drum, header and piping, butt weld at the heading surface pipe and the butt weld of the tube and fittings if the structure permits.

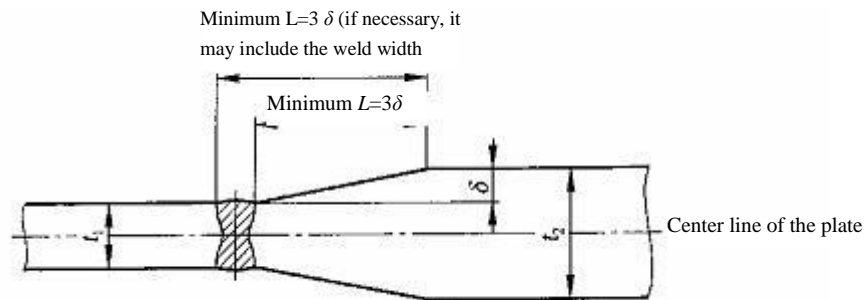
4.3.3.3 Butt joint of pressure parts

(1) Center lines of the steel plate on both sides of the longitudinal (circumferential) weld at the drum (shell) generally shall be aligned, and edges on one side are also allowed to be aligned where the thicknesses of steel plates on both sides of the circumferential weld at the drum (shell) are different.

(2) Where two elements or steel plates with different nominal wall thicknesses are butt joint, if the nominal edge thickness difference on either side is greater than the edge deviation value specified in Article 4.3.3.4 of this Regulation, the edges of the thick plate shall be cut parallel and level to the sheet edges. The cut bevel shall be smooth with the slope less than or equal to 1: 3; if necessary, the weld width may be calculated in the bevel, see Figure 4-1.



(a) Longitudinal Weld



(b) Circumferential weld

δ - nominal edge deviation; t_1 - sheet thickness; t_2 - thickness of the thick plate; L - cut-thin length

Figure 4-1 Steel Plates in Different Thicknesses (Butt Joint of Elements)

4.3.3.4 Weld edge deviation

The assembling of longitudinal (circumferential) weld at the drum (shell), butt welds at head (tube plate) or assembled welds at two elements shall meet the following requirements:

(1) The actual edge deviation value of the longitudinal weld or the steel plates on both sides of the butt welds at the head (tube plate) shall be less than or equal to 10% of the nominal plate thickness and less than or equal to 3mm; where the plate thickness is greater than 100mm, it shall be less than or equal to 6mm;

(2) The actual edge deviation value of the steel plates on both sides of the circumferential weld (including the plate thickness difference) shall be less than or equal to 15% of the nominal plate thickness with additional 1mm and less than or equal to 6mm; where the plate thickness is greater than 100mm, it shall be less than or equal to 10mm;

(3) Where two elements or steel plates with different thicknesses are butt jointed and edges are tapered, they shall be treated as with same steel plate thickness, and the above-mentioned nominal plate thickness refers to the sheet thickness; as for steel plates with different thicknesses

are butt jointed but not be tapered, the above-mentioned nominal plate thickness refers to the thickness of the thick plate.

4.3.3.5 Roundness and angularity

The difference between the maximum and the minimum inside diameters of any cross section in the drum (shell) shall be less than or equal to 1% of the nominal inside diameter. The angularity of the longitudinal weld at the drum (shell) shall be less than or equal to 4mm.

4.3.3.6 Weld repairing

(1) If the welded joints of the pressure parts are discovered with defects that exceed the limit through inspection, the welding unit shall find out the reasons and may repair them only after formulating the feasible repair plan;

(2) Before repair welding, the defect shall be thoroughly eliminated; after the repair welding, appearance examination and non-destructive testing shall be carried out for the repair welding area; in addition, the elements (components) subject to post-weld heat treatment, post-weld heat treatment shall be carried out after the repair welding.

(3) The same position shall not be repaired over 2 times; if over 2 times, the approval of the technical principal in the unit shall be obtained and the repair positions, times and conditions shall be kept in the technical files of the boiler.

4.4 Heat treatment

4.4.1 Heat treatment scope

(1) As for the carbon steel pressure part, the post-weld heat treatment (PWHT) shall be carried out for the butt joint whose nominal wall thickness is more than 30mm, or the T-shaped joint of internal combustion boiler's drum and tube sheet whose nominal wall thickness is more than 20mm;

(2) As for the alloy steel pressure part, its PWHT thickness limit shall be in accordance with the relevant standard;

(3) Not only the PWHT, but also the effect of cold and hot forming on material performance in deformation zone and the working condition of the pressure element shall be considered when conducting heat treatment.

4.4.2 Heat treatment facilities

Heat treatment facilities shall be equipped with temperature measuring equipment, which can record the duration and temperature curve of the heat treatment automatically. The temperature measuring equipment shall be able to reflect the actual temperature of the workpiece accurately.

4.4.3 The procedure requirements before heat treatment

Pressure part requiring PWHT may be conducted after the welding (including the welding connecting non-pressurized elements) and the inspection are fully completed.

4.4.4 Heat treatment process

Heat treatment process shall be compiled according to the requirements of relevant standards and drawings before heat treatment. The specific process requirements for on-site heat treatment shall be proposed in case of those requiring on-site heat treatment.

At least, the following requirements shall be met for the PWHT process:

(1) When the joint of dissimilar steel is required to be heat treated to relieve stress after welding,, the temperature hereof shall not be greater than the lower critical point(Ac_1) of any steel on either side of the welded joint;

(2) The whole heat treatment shall be adopted for PWHT. If the segmented heat treatment is adopted, there shall be a overlap section of 1500mm on every heated section, and also shall have thermal insulation devices for the extending part of the furnace.

(3) For the repair welding and its circumferential joint partial heat treatment, the weld and the heating width at its both sides shall not be less than 3 times of the steel plate thickness at both sides (take the larger value) of the welded joint or not be less than 200mm respectively.

4.4.5 Heat treatment record

In the process of PWHT, various parameters of specification of heat treatment shall be recorded in detail. After the heat treatment, relevant responsible personnel shall check in detail whether the record is in accordance with the process requirements.

4.4.6 The procedure requirements after heat treatment

The boiler pressure part which have been heat treated shall avoid being directly welded elements on its surface. If unavoidable, in the case that all the following conditions are satisfied simultaneously, the PWHT is not needed. Otherwise PWHT is needed:

- (1) The material of pressure part is carbon steel or carbon manganese steel;
- (2) The calculated thickness of the fillet weld is not larger than 10mm;
- (3) The welding is carried out under the assessment-qualified welding process;

- (4) 100% surface non-destructive testing is carried out for the fillet weld.

4.5 Welding inspection and relevant inspection

For boiler pressure part and its welded joints, their quality inspections include appearance inspection, ball passing test, chemical composition analysis, non-destructive testing, mechanical property inspection, and hydrostatic test, etc.

4.5.1 Appearance inspection for welded joints of the pressure part

Welded joints of the pressure part, including welding joints of non-pressurized element and pressure element, shall be carried out appearance inspection. And they shall at least meet the following requirements:

- (1) The overall dimension of the weld joint shall meet the requirements of design drawing and process document;
- (2) The height of butt weld shall not be lower than that of base material surface, thus can make sure the surface of the weld joint and base material be smooth. There shall be no crack, slag inclusion, arc crater or gas hole on the surface of weld joint and heat-affected zone;
- (3) There shall be no undercut on the longitudinal weld (or girth weld) at the drum (shell), boiler furnace and the splicing weld at the head (tube sheet). The undercut depth of other welds shall not be more than 0.5mm. Total undercut length for both sides of pipe weld shall not be more than 20% of pipe circumference and shall not exceed 40mm.

4.5.2 Ball passing test for butt-welded heating surface pipe

Ball passing test for butt-welded heating surface pipe shall be carried out according to the provisions of relevant standard.

4.5.3 Chemical composition analysis

Chemical composition spectral analysis confirmation shall be carried out on the butt joint weld and base material of alloy pipe and pipe fittings.

4.5.4 Non-destructive testing

4.5.4.1 Qualification for non-destructive testing personnel

The non-destructive testing personnel shall be qualified in the relevant safety technical regulations to obtain a corresponding personnel certificate. And then they can take charge of the non-destructive testing in correspondence with the method and level in the certificate.

4.5.4.2 Basic methods of non-destructive testing

Methods of non-destructive testing include radiography (RT), ultrasound (UT), magnetic particle (MT), penetration (PT), eddy currents (ET) and etc. The manufacturer shall select testing method and develop corresponding testing process according to the requirements of design, process and relevant technical specification.

Ultrasonic Time-of-Flight Diffraction Technique (TOFD) shall be adopted together with pulse echo method (PE), and the testing conclusion shall be comprehensively judged by the result of TOFD and PE.

4.5.4.3 Standard of non-destructive testing

Non-destructive testing method of the boiler pressure part shall meet the requirements of "Non-destructive Testing of Pressure Equipments" (NB/T 47013, JB/T 4730). The X radiographic real-time imaging of pipe butt joint shall meet the relevant technical regulations.

4.5.4.4 Technical level of non-destructive testing and the quality level of the welded joint

- (1) For the welded joints of the boiler pressure part, its radiographic testing technical level shall not be less than Class AB, and quality level for the welded joints shall not be less than Class II;

(2) For the welded joints of the boiler pressure part, its ultrasonic testing technical level shall not be less than Class B, and quality level for the welded joints shall not be less than Class I;

(3) The quality level of welded joints for surface inspection shall not be less than Class I.

4.5.4.5 Timing of non-destructive testing

Non-destructive testing of welded joints shall be carried out after the shape, dimension and appearance are qualified in inspection. And it shall be in accordance with the following principles:

(1) The material prone to appearing delayed crack, the non-destruction testing shall be carried out at least 24 hours after welding;

(2) As for the welded joints prone to appearing reheating crack, the surface non-destructive testing shall be rechecked after the final heat treatment;

(3) Non-destructive testing for splicing joints of head (tube sheet), corrugated furnace and water-leg ring shall be carried out after forming. If non-destructive testing is carried out before forming, then it shall be carried out one more time in the small arc transition area after forming;

(4) For the welded joints of electroslog welding, the ultrasonic testing shall be carried out after normalizing.

4.5.4.6 Selection of method and proportion for non-destructive testing

(1) As for the steam boiler pressure part, the method and proportion of non-destructive testing of its welded joints shall meet the requirements of Table 4-1;

Table 4-1 Non-destructive Testing Method and Proportion of Steam Boiler

Boiler equipment classification	Level A	Level B	Level C	Level D
Tested position	Testing method and proportion			
Drum (shell), longitudinal and circumferential butt joint of start-up (steam-water) separator, head (pipe plate), splicing joint of water-leg ring and longitudinal butt joint of header	100% radiographic or ultrasonic testing (Note 4-1)	100% radiographic or ultrasonic testing (Note 4-1)	20% radiographic testing is needed for each weld joint at least	10% radiographic testing
Longitudinal and circumferential butt joint of boiler furnace (including corrugated furnace), butt joint of reversal chamber and splicing joint of boiler furnace top	-	20% radiographic testing		-
As for the internal combustion shell boiler,	-	100% ultrasonic testing		-

T-shaped joint of the tube sheet and the shell; and as for the once-through boiler, the T-shaped joint of the header drum			
As for the internal combustion shell boiler, the T-shaped joint of its tube sheet and boiler furnace/reversal chamber	-	50% ultrasonic inspection	-
Fillet joint of the centralized downcomer	100% ultrasonic testing	-	-
Circumferential butt joint of header, piping and other pipe fittings whose outside diameter is more than 159mm or lining thickness is larger than or equal to 20mm	100% radiographic or ultrasonic testing (Note 4-1)		-
Circumferential butt joint of header, piping and pipe whose outside diameter is less than or equal to 159 mm (resistance welding of heating surface pipe is excluded)	(1) P ≥9.8 MPa, 100% radiographic or ultrasonic testing (installation site, 50% of the number of joints); (2) P <9.8 MPa, 50% radiographic or ultrasonic testing (installation site, 25% of the number of joints)	10% radiographic testing	
Fillet joint of drum and header’s pipe joint	(1) 100% ultrasonic testing for the fillet joint whose outside diameter is more than 108mm; (2) Surface inspection is carried out for at least 20% quantity of joints whose outside diameter is less than or equal to 108mm	-	

Note 4-1: Radiographic testing shall be adopted for welded joints whose lining thickness is less than 20mm. Ultrasonic testing shall be adopted for welded joints whose lining thickness is larger than or equal to 20mm, and digital ultrasonic detector is needed. When the analog ultrasonic detector is used, additional 20% partial radiographic testing is needed.

Note 4-2: Non-destructive testing may be omitted for the water supply piping whose water temperature is less than 100°C.

(2) Non-destructive testing proportion and method for Level B hot-water boiler or above, shall meet the requirements for the corresponding level of steam boiler in Table 4-1. For the main weld of the main pressure parts for the Level C hot-water boiler, 10% radiographic or ultrasonic testing shall be carried out;

(3) Non-destructive testing proportion and method for pressure-bearing organic heat transfer material boiler shall meet those specified in Table 4-2. Non-destructive test may be omitted for the non-pressure-bearing organic heat transfer material boiler.

Table 4-2 Non-destructive Testing Method and Proportion for Pressure-bearing Organic Heat Transfer Material Boiler

Joint positions	Non-destructive testing method and proportion	
	Gas phase	Liquid phase
Longitudinal (circumferential) welds of drum and flash tank, butt joints in segmental welded head	100% radiographic testing	50% radiographic testing
T-shaped joint of pressure parts	100% ultrasonic testing	50% ultrasonic testing
Welded joints of condensate tank, expansion tank and storage tank	20% radiographic testing	
Butt joint of pipe whose outside diameter is larger than or equal to 159mm	Radiographic testing for 20% of the number of joints	
Butt joint of pipe whose outside diameter is less than 159mm	Radiographic testing for 10% of the number of joints	

(4) For welded joints at the tube or piping and elbow without straight section for the steam boiler, Level B hot-water boiler or above and pressure-bearing organic heat transfer material boiler, 100% radiographic or ultrasonic testing shall be carried out.

4.5.4.7 Spot non-destructive testing

Spot non-destructive testing positions of boiler pressure parts shall be determined by the manufacturer, but it shall include positions of the intersect butt joint parts of longitudinal welds and circumferential welds .

For the welded joints examined by the spot non-destructive testing, if it is discovered that any defect on either end of the testing position is likely to be extended, a supplemental testing shall be carried out in the extended direction of the defect. In the case that the defect exceeds the limit, a supplement testing shall be carried out for the extending parts on both sides of the defect, and the tested length shall not be less than 200mm. If the supplement testing result is still unqualified, a 100% testing shall be carried out for the welded joints. For the unacceptable butt joint, a supplemental testing shall be carried out for double sampling quantity of the butt joints of the tube welded by the welder on the current day; if it is still unqualified, testing shall be carried out for all the welded joint of the tube welded by the welder on the current day.

As for the boiler pressure parts with spot non-destructive testing, the manufacturer shall also be responsible for the quality of parts which are not performed any nondestructive testing.

4.5.4.8 Qualification evaluation for combination non-destructive testing methods

In the case that the boiler pressure parts are tested by various methods of non-destructive testing, the testing result shall be assessed according to respective acceptance criteria. The non-destructive testing is considered to be qualified after the assessment is qualified.

4.5.4.9 Management for non-destructive testing report

The manufacturer shall truthfully fill in the non-destructive testing record, correctly sign and issue the testing report, keep information such as the process card, original record, report, tested position drawing, radiographic film, CD or electronic document (including defect repair record). The storage period shall be at least 7 years.

4.5.5 Mechanical property inspection

4.5.5.1 Basic requirements for welding product welded test coupons

In order to examine the mechanical property of welded joints, the welded test coupons shall be produced. For the manufacturer with stable welding quality, the production of welded test coupons can be exempted after approved by the technical principal. The welded test coupon of longitudinal welds shall be manufactured in case of one of the following conditions:

- (1) The manufacturer manufactures the first five boilers according to new welding

process;

(2) Drum or header components made of alloy steel, and heat treatment is required to perform according to the process requirement;

(3) Welded test coupons are required to be manufactured according to the boiler design drawing.

4.5.5.2 Welded test coupons production

(1) A piece of welded test coupons shall be produced for the longitudinal weld of each drum (shell) and header components. The test coupon of longitudinal weld shall be welded as the extension of the product's longitudinal weld (electroslag welding is excluded);

(2) Product welded test coupons shall be welded by the welder welding the product, and the material for test, welding materials and process conditions shall be the same with those of the product. The test coupons shall be stamped with the identification of the welder and the inspector after welding;

(3) When heat treatment is necessary, test coupons shall be heat treated together with the representative product in the same furnace;

(4) Quantity and size of the welded test coupons shall be sufficient to meet the requirements for cutting off specimens for inspection and repeat test.

4.5.5.3 Test specimen preparation and performance examination

(1) After the appearance and non-destructive testing have been conducted for the welded test coupon, the test specimen preparation shall be carried out on its qualified parts;

(2) As for the mechanical property examination category, specimen quantity, sampling and processing requirements, test methods, qualified indexes and repeat test, they shall meet the requirements of "Mechanical Property Tests of Products Welded Test Coupons for Pressure Equipment" (NB/T 47016/ JB/T 4744). And the longitudinal weld of drum and header components shall also subject to a full weld tensile test according to the relevant provisions of Articles 4.3.2.2 and 4.3.2.3 in this Regulation.

4.5.6 Hydraulic test

4.5.6.1 Basic requirements

(1) Hydraulic test shall be carried out for the boiler pressure part after non-destructive testing and heat treatment;

(2) The hydraulic test site shall be provided with reliable safety protection facilities;

(3) The hydraulic test shall be carried out when the ambient temperature is greater than or equal to 5℃, and if the temperature hereof is lower than 5℃, the anti-freezing measures shall be adopted;

(4) For the hydraulic test, the clean water shall be adopted, and its temperature shall be greater than the dew point of the ambient against condensation, but shall not be too high to cause vaporization and oversize temperature stress;

(5) In the hydraulic test of the alloy steel pressure part, the water temperature shall be greater than the frangibility transformation temperature of the steel used;

(6) When the hydraulic test is carried out for the austenitic pressure part, chlorine ion content in water shall be controlled to be less than 25mg/L. If the requirement can not be met, water stain shall be removed immediately after the hydraulic test.

4.5.6.2 Hydraulic test pressure and pressure holding time

When carrying out hydraulic test, membrane stress shall not exceed the element's 90% yield point under the test temperature. Pressure and pressure holding time of boiler hydraulic test shall meet this requirement.

4.5.6.2.1 The integral hydraulic test

The pressure holding time of the integral hydraulic test is 20min, and the test pressure shall be in accordance with the requirements of Table 4-3.

Table 4-3 Hydraulic Test Pressure

Name	Working pressure of boiler drum (shell)	Test pressure
Boiler proper	<0.8MPa	1.5 times of the boiler drum (shell) working pressure, but not less than 0.2 MPa
Boiler proper	0.8MPa~1.6MPa	The working pressure of boiler drum (shell) + 0.4 MPa
Boiler proper	>1.6MPa	1.25 times of the boiler drum (shell) working pressure
Once-through boiler proper	Any pressure	1.25 times of the media outlet pressure ,and not less than 1.1 times of the economizer inlet pressure
Reheater	Any pressure	1.5 times of the reheater working pressure
Cast-iron economizer	Any pressure	1.5 times of the economizer working pressure

Note 4-3: The hydraulic test of boiler proper in Table 4-3 excludes that of reheater and cast-iron economizer.

4.5.6.2.2 Hydraulic test of parts

(1) The test pressure of boiler drum and start-up (steam-water) separator which is delivered in the form of components is 1.25 times as much as their working pressure, and the pressure holding time is at least 20 min;

(2) The test pressure of header components of delivery boiler in the form of spare parts is 1.5 times as much as their working pressure, and the pressure holding time is at least 5min;

(3) The test pressure of butt welded heating surface pipes and other pressure pipe fittings is 1.5 times as much as their working pressure, and the pressure holding time is at least 10s ~ 20s;

(4) The test pressure of heating surface assemblies is 1.5 times as much as their working pressure, and the pressure holding time is at least 5min.

Note 4-4: As for such components as open header, pipe joint header (not-in-row in the heating surface and in-row with inner-bore welded cap), start-up (steam-water) separator, piping, storage tank, desuperheater and distribution header, all of their welds shall be 100% qualified in the non-destructive testing, and argon welding shall be carried out for priming of the butt-welded heating surface pipes and other pressure pipe fittings and they shall be 100% qualified in the non-destructive testing, so as to ensure the welding quality hereof. The manufacturer is allowed not to carry out the hydraulic test individually.

4.5.6.3 The process control of the hydraulic test

The hydraulic pressure shall be slowly increased or decreased in the hydraulic test. When the hydraulic pressure rises to the working pressure, the boosting shall be halted to check whether there has been any leakage or abnormality and then rises up the pressure to the test pressure. After the pressure holding time is reached the pressure shall be decreased to the working pressure for check, during which the pressure shall be remained the same.

4.5.6.4 The acceptable requirements for the hydraulic test

(1) The metal walls and welds of pressure part are free from water drops and water mist;

(2) The expanding mouth is free from dripping after the pressure is down to working pressure;

(3) The sealing place of cast-iron boiler sections is free from dripping after the pressure is down to rated working pressure;

(4) No visible residual deformation is found after the hydraulic test.

4.6 Delivery information, metal nameplate and mark

4.6.1 Delivery information

For the delivered products, the boiler manufacturer shall provide the following safety-related technical information as a minimum:

(1) Boiler drawing (including general drawing, installation drawing and main pressure part drawing);

(2) The strength calculation or summarized table of calculation results for pressure part;

(3) The calculation sheet or summarized table of calculation results for the safety valve's discharge;

(4) The boiler quality certificates include product conformity certificate (including product data sheet of boilers, see Annex A), metal material certification, welding quality certification and hydraulic test certification;

(5) Installation instruction and operating instruction of the boiler;

(6) The data of modifying the pressure element which is inconsistent with design document;

(7) Water flow diagram and hydrodynamic calculation sheet or calculation result summary sheet of the hot water boiler (excluding the natural-circulation shell boiler);

(8) Medium flow diagram and liquid membrane temperature calculation sheet or calculation result summary sheet of the organic heat transfer material boiler.

The signature and stamp of responsible inspection engineer and quality assurance engineer and official seal shall be on the product conformity certificate.

4.6.2 The delivery information of Level A boiler

As for Level A boiler, not only the requirements of Article 4.6.1 of this Regulation shall be met, but also the following technical information shall be provided:

(1) Thermal calculation sheet or thermal calculation result summary sheet of boiler;

(2) Calculation sheet or calculation result summary sheet of superheater and reheater's wall temperature;

(3) Calculation sheet or calculation result summary sheet of boiler flue-gas and air resistance;

(4) Thermal expansion system diagram;

(5) The calculation sheet or calculation result summary sheet of high-pressure boiler or above water circulation (including steam-water resistance);

(6) The high-pressure boiler or above steam and water circuit diagram;

(7) The setting value of each safety protection device for high-pressure boiler or above.

Before starting the acceptance of the whole set of utility boiler, the boiler manufacturer shall provide complete boiler delivery technical information.

4.6.3 Nameplate of the product

The boilers shall be arranged metal nameplate on the conspicuous places and at least specified the following items:

(1) Name of the manufacturer;

(2) Type of boiler;

(3) Equipment code (see Annex B);

(4) Product serial number;

(5) Nominal evaporating capacity (t/h) or rated thermal power (MW);

- (6) Rated working pressure (MPa);
- (7) Rated steam temperature (°C) or rated outlet, inlet water (oil) temperature (°C);
- (8) Reheated-steam inlet, outlet temperature (°C) and inlet, outlet pressure (MPa);
- (9) Level and serial number of boiler manufacturing license;
- (10) Manufacturing date (yy/mm).

The upper-right corner of nameplate shall have the place left to stamp the manufacture supervisory inspection sign.

4.6.4 Delivery stamp for pressure components

As for the delivered boiler in the form of spare parts, whose main pressure components such as boiler drum, superheater header, reheater header, water-cooled wall header, economizer header, desuperheater and start-up (steam-water) separator shall be stamped with their own name (or diagram number) and product serial number on their heads or end caps.

5 Installation, Alteration and Repair

5.1 Basic requirements

(1) The boiler manufacturer may install, repair and alter the integrative (assembling) boiler manufactured by themselves. However, if they are engaged in other boilers' installation, alteration and significant repair, they shall obtain "Installation, Alteration, Repair & Maintenance License of Special Equipment". Then they may be engaged in the boiler installation, alteration and repair working in the allowable range;

(2) Before the construction of boiler installation, alteration and repair, the construction unit shall transact informing and apply supervisory inspection, and then they may start construction.

5.2 Installation

5.2.1 Installation position

Generally, the boiler shall be installed in the separately built boiler house. And its installation position and boiler house shall fulfill with the relevant requirements of "Code for Design of Boiler Plant" (GB 50041), "Code of Design on Building Fire Protection and Prevention" (GB 50016) and "Code for Fire Protection Design of Tall Buildings" (GB 50045).

5.2.2 Standard for installation

As for the boiler installation, not only the requirements of this Regulation, but also the following corresponding standard shall be met:

(1) As for Level A boiler, the boiler installation shall be in accordance with the relevant technical requirements of "Technical Specification for Thermal Power Erection and Construction Part 2: boiler unit" (DL 5190.2). As for Level B boiler or below, the boiler installation shall be in accordance with "Code for Construction and Acceptance of Boiler Installation" (GB 50273) and the regulations of relevant standard. And the hot-water boiler shall be also in accordance with the relevant requirements of "Code for Acceptance of Construction Quality of Water Supply Drainage and Heating Works" (GB 50242);

(2) As for Level A boiler, the boiler external piping installation shall be in accordance with the relevant technical requirements of "Technical Specification for Thermal Power Erection and Construction - Part 5: Piping and System" (DL 5190.5) and "The Code of the Welding for Power Plant" (DL/T 869). And as for Level B boiler or below, the installation shall be in accordance with the relevant technical requirements of "Code for Construction of Industrial Metallic Piping Engineering" (GB 50235) and "Code for Construction of Field Equipment, Industrial Pipe Welding Engineering" (GB 50236).

5.2.3 Fuel pipeline and gas alarm device

As for the boiler installed in the multi-rise or high-rise buildings, seamless steel tube shall

be adopted for the fuel supply pipeline and argon arc welding shall be adopted for priming during the welding. When the fuel is used as the fuel, it shall be provided with gas leak detection & alarm device.

5.2.4 Welding

As for the welding work in the boiler installation process, not only the relevant requirements stipulated in Chapter 4 of this Regulation, but also the following requirements shall be met:

- (1) When the environmental temperature of boiler installation is below 0°C or the weather is bad, protection measures shall be taken;
- (2) Except the cold-drawn welded-joint specified in the design, forced alignment shall not be made for the welded parts and the cold-drawn tool used for installation of the cold-drawn welded-joint may be dismantled after the completion of the welding and the heat treatment for the entire welded joint.

5.2.5 Heat treatment, non-destructive testing and expanding

The heat treatment, non-destructive testing and expanding in the boiler installation process shall be in accordance with the relevant requirements in Chapter 4 of this Regulation.

5.2.6 Hydraulic test

- (1) The hydraulic test in the boiler installation process shall be in accordance with the relevant requirements in Chapter 4 of this Regulation.
- (2) The allowable test pressure drop for the hydraulic test of the integral boiler shall be in accordance with those specified in Table 5-1.

Table 5-1 The Allowable Pressure Drop of Test Pressure for the Integral Boiler Hydraulic Test

Boiler type	Allowable pressure drop (Δp)
Level A high-pressure boiler or above	$\Delta p \leq 0.60 \text{ MPa}$
Level A sub-high-pressure boiler or below	$\Delta p \leq 0.40 \text{ MPa}$
Level B boiler $>20 \text{ t/h}$ (14MW)	$\Delta p \leq 0.15 \text{ MPa}$
Level B boiler $\leq 20 \text{ t/h}$ (14MW)	$\Delta p \leq 0.10 \text{ MPa}$
Levels C and D boiler	$\Delta p \leq 0.05 \text{ MPa}$

5.2.7 The specific requirements of utility boiler installation

5.2.7.1 Water flushing of thermal system

The thermal system of utility boiler shall be subject to cold water flushing and hot water flushing, and pH of flushing water is 9.0~9.5. The water quality of boiler cold water flushing and hot water flushing shall be in accordance with the relevant technical requirements of "Guide of Chemistry Supervision of Thermal Equipments for Power Station Capital Construction" (DL/T 889).

5.2.7.2 Boiler commissioning

In utility boiler commissioning process, all the operations shall be carried out by the operators well-trained and obtained the corresponding Special Equipment Operator Certificate with the supervision and instruction of the commissioning personnel. In the first start-up process, the temperature and pressure shall be boosted slowly. At the same time, the expansion values of all parts shall be controlled within the design scope.

5.2.7.3 The start-up of boiler unit

When the utility boiler starts, the following thermal equipment and protective device shall be commissioned and put into operation:

- (1) Data acquisition system;
- (2) Furnace safeguard monitoring system;
- (3) The sub-function and interlock of the related auxiliary system;
- (4) All remote operating systems.

5.2.7.4 Acceptance

After the boiler installation, the boiler user is responsible for organizing acceptance, and the following requirements shall be met:

- (1) As for the 300MW-or-above utility boiler, all of its safety indexes shall meet the relevant standards after 168H consecutive full-load trial operation for the whole unit;
- (2) After 72H consecutive full-load trial operation for the whole unit of the 300MW-or-below utility boiler, all its equipment shall be conducted an overall inspection. And after the defect is fixed, the equipment shall be conducted another 24H non-defective consecutive full-load trial operation for the whole unit.

5.3 Boiler alteration

5.3.1 The definition of boiler alteration

The boiler alteration refers to the structural change of boiler or the change of boiler firing mode.

5.3.2 Alteration design

- (1) The design of boiler alteration shall be carried out by the boiler manufacturer with corresponding qualification;
- (2) The rated operating pressure and rated operating temperature shall not be boosted after the boiler alteration;
- (3) The hot water boiler shall not be changed to the steam boiler;
- (4) Boiler alteration program shall include necessary calculating data, design drawing and construction technology program. When the steam boiler is changed to the hot water boiler or the hot water boiler pressure element is changed, it shall be provided with water flow

diagram and hydrodynamic calculation sheet. And technology check shall be carried out for the safety accessories, auxiliary device and water treatment measures.

5.3.3 The technical requirements for construction of the boiler alteration

The technical requirements shall be referred to the corresponding professional technical standards and relevant technical regulations of the boiler.

5.4 Boiler repair

5.4.1 The definition of important repair for the boiler

5.4.1.1 Important repair for the Level A boiler

- (1) The replacement of boiler drum, start-up (steam-water) separator, desuperheater and centralized downcomer and the welding repair of main welds;
- (2) The replacement of above-50% whole-group heating surface;
- (3) The replacement and removal of header, piping and pipe fitting whose outside diameter is greater than 273 mm and the welding repair of longitudinal (circumferential) welds;
- (4) The repair of large plate beam weld.

5.4.1.2 The important repair of Level B boiler or below

- (1) The replacement and removal of main pressure parts such as drum, head, tube sheet, boiler furnace, boiler furnace top, reversal chamber, water-leg ring and header;
- (2) The replacement quantity of heating surface pipe shall be 10% more than that of this type heating surface pipe (its classification may be divided into water-cooled wall, convection tube bank, superheater, economizer and fire tube) and be more than 10 roots, and the replacement of whole group heating surface of the once-through boiler and cross-flow boiler.

5.4.2 The technical requirements of boiler repair

- (1) The replacement requirements of boiler pressure part shall not be lower than that of original design according to the corresponding professional and technical standards and relevant technical requirements of boiler repair.
- (2) The pressure part (component) shall not be repaired under the pressure or higher boiler water temperature;
- (3) Before the removal and welding repair of the boiler drum (shell), the welding process qualification shall be carried out and the process test coupon shall be welded by the repair unit; and when removal is adopted for repairing the boiler pressure part (component), the repair plate shall be in regular shape; if a square repair plate is adopted, its four corners shall be rounded to ensure their radius be not less than 100mm (if one side of the removal plate is overlapped with the original weld, two corners of this side may be excluded);
- (4) The boiler pressure part (component) shall not be repaired with pasted-repair method. When its local damage produced by stress corrosion, creep and fatigue need repairing, the

replacement or the removal method shall be adopted.

5.4.3 The inspection after the pressure part (component) repair

(1) After the repair, the boiler pressure part (component) shall be subject to appearance inspection and non-destructive testing (thereinto the removal weld shall be carried out 100 % non-destructive testing). And it shall be also carried out hydraulic test where necessary and its acceptance criteria shall be in accordance with the relevant requirements in Chapter 4 of this Regulation;

(2) When the overlaying repair is adopted, the surface non-destructive testing shall be carried out after the welding; as for the utility boiler, the repair shall be also in accordance with the relevant technical requirements of "Technical Guide of Welding Repair for Boiler Drum in Fossil - Fired Power Plants"(DL/T 734).

5.4.4 PWHT

When the heat-treated boiler pressure part is under repair, it shall be carried out PWHT according to the original heat treatment procedure after the welding.

5.5 Completion information

After the completion of boiler installation, alteration and repair, the technical information such as drawing, process document and construction quality certificate shall be delivered to the user to keep them in the boiler safety technical files.

6 Safety Accessories and Instruments

6.1 Safety valve

6.1.1 Basic requirements

Technical requirements for the manufacturing license, type test and nameplate of the safety valve shall be in accordance with those specified in "Safety Technical Supervision Regulation for Safety Valves" (TSG ZF 001).

6.1.2 Arrangement

Each boiler shall be arranged with at least two safety valves (including drum safety valve and superheater safety valve). If any of the following requirements is met, one safety valve may be arranged:

- (1) The steam boiler is provided with nominal capacity less than or equal to 0.5t/h;
- (2) The steam boiler is provided with nominal capacity less than 4t/h and equipped with a reliable overpressure interlock protection device;
- (3) The hot-water boiler is provided with rated thermal power less than or equal to 2.8MW.

6.1.3 Other requirements for safety valve arrangement

In addition to meeting the requirements of Article 6.1.2 in this Regulation, the safety valves shall also be arranged at the following positions:

- (1) At the reheater outlet and at the external start-up (steam-water) separator of the once-through boiler;
- (2) In front of the stop valve between the two-level connecting pipeline of superheated steam system for the once-through steam boiler;
- (3) On the drum and superheater for each pressure level with regard to the multi-pressure level exhaust heat boiler.

6.1.4 Selection of safety valve

(1) As far as the steam boiler is concerned, fall-lift spring-loaded safety valve, deadweight safety valve or controlled safety valves such as pulsed safety valve, pneumatic safety valve, hydraulic safety valve and electromagnetic safety valve shall be adopted. The safety valve selected shall comply with the requirements in "Safety Technical Supervision Regulation for Safety Valve" and of the corresponding technical standards.

(2) As for the steam boiler with rated working pressure less than or equal to 0.1MPa, direct-loaded safety valve or water-sealed safety device may be adopted; when the hot-water boiler is provided with the water-sealed safety device, the safety valve may not

be installed; and the inside diameter of sealing water pipe of the water-sealed safety device shall be determined according to the nominal capacity (rated thermal power) and rated working pressure of the boiler and shall be greater than or equal to 25mm, the safety valve shall not be installed and anti-freezing measures shall be provided with.

6.1.5 Total discharge of safety valve for the steam boiler

For the steam boiler, the total discharge of safety valves on the drum (shell) and superheater shall be greater than the nominal capacity; for the utility boiler, the total discharge of safety valves shall be greater than its maximum continuous rating, and when all safety valves on the drum (shell) and superheater are opened, the steam pressure in the

drum (shell) shall not exceed 1.1 times of the calculated pressure during the design; for the reheater, the total discharge of safety valve shall be greater than its maximum designed steam flow.

6.1.6 Determination of discharge of safety valve for the steam boiler

For the steam boiler, the diameter of flow channel for the safety valve shall be larger than or equal to 20mm. And the discharge shall be calculated according to one of the following methods:

- (1) It shall be calculated according to the rated discharge provided by the safety valve manufacturer;
- (2) It shall be calculated according to Formula (6-1);

$$E=0.235A (10.2p+1) K \quad (6-1)$$

Where,

E - the theoretical discharge of safety valve, kg/h;

p - the steam pressure (gauge pressure) at the safety valve inlet, MPa;

A - the flow channel area of safety valve, mm^2 , and it is may be calculated with $\frac{\pi d^2}{4}$;
 d - the flow channel diameter of safety valve, mm;

K - the steam specific volume correction coefficient at the safety valve inlet; it shall be calculated according to Formula (6-2):

$$K=K_p K_g \quad (6-2)$$

Where,

K_p - the pressure correction coefficient;

K_g - the superheat correction coefficient;

K , K_p and K_g shall be selected and calculated according to those specified in Table 6-1.

Table 6-1 Correction coefficients at the Safety Valve Inlet

$p(\text{MPa})$		K_p	K_g	$K=K_p K_g$
$p \leq 12$	Saturation	1	1	1
	Superheat	1	$\sqrt{\frac{V_b}{V_g}} \text{ (Note 6-1)}$	$\sqrt{\frac{V_b}{V_g}} \text{ (Note 6-1)}$
$p > 12$	Saturation	$\sqrt{\frac{2.1}{(10.2 p + 1) V_g}}$	1	$\sqrt{\frac{2.1}{(10.2 p + 1) V_g}}$
	Superheat	$\sqrt{\frac{2.1}{(10.2 p + 1) V_g}}$	$\sqrt{\frac{V_b}{V_g}} \text{ (Note 6-1)}$	$\sqrt{\frac{2.1}{(10.2 p + 1) V_g}}$

Note 6-1: $\sqrt{\frac{V_b}{V_g}}$ may also be replaced by $\sqrt{\frac{1000}{(1000 + 2.7T_g)}}$.

Hereinto:

V_g - the superheat steam specific volume, m^3/kg ;

V_b - the saturation steam specific volume, m^3/kg ;

T_g - the superheating temperature, $^{\circ}\text{C}$.

(3) It shall be calculated according to the formulas in "Safety Valves - General Requirements" (GB/T 12241) or in "Specification for safety valve of fossil power station" (JB/T 9624).

6.1.7 Discharge of safety valve outside the drum

The discharge of safety valves at the superheater and reheater outlets shall guarantee that the superheater and the reheater can be sufficiently cooled. The discharge of safety valve for the external start-up (steam-water) separator of the once-through steam boiler shall exceed the steam generation amount when the once-through steam boiler is started.

6.1.8 Discharge capacity of safety valve for the hot-water boiler

As for the hot-water boiler, discharge capacity of the safety valve shall guarantee that the pressure inside the boiler after all safety valves are opened shall not exceed 1.1 times of the design pressure. And the flow channel diameter for the safety valve shall be selected according to the following principles:

(1) For the boiler with the rated outlet water temperature less than 100°C, it may be selected according to those specified in Table 6-2;

Table 6-2 Flow Channel Diameter Selection of Safety Valve for the Boiler Below 100°C

Rated thermal power of the boiler (MW)	$Q \leq 1.4$	$1.4 < Q \leq 7.0$	$Q > 7.0$
Flow channel diameter for the safety valve (mm)	≥ 20	≥ 32	≥ 50

(2) For the boiler with the rated outlet water temperature larger than or equal to 100°C, the number and flow channel diameter of the safety valve shall be calculated according to formula (6-3).

$$ndh = \frac{35.3Q}{C(p + 0.1)(i - i_j)} \times 10^6 \quad (6-3)$$

Where,

n - the number of the safety valve;

d - the flow channel diameter of safety valve, mm;

h - the opening height of the safety valve spool, mm;

Q - the rated thermal power of the boiler, MW;

C - the emission coefficient, which is selected according to the data provided by the safety valve manufacturer or according to the following values:

When h is less than or equal to $d/20$, C is 135 and when h is greater than or equal to $d/4$, C is 70;

p - the set pressure of the safety valve, MPa;

i - the saturated steam enthalpy of the boiler under the rated outflow pressure, kJ/kg;

i_j - the enthalpy of the boiler under the rated inflow pressure, kJ/kg.

6.1.9 Set pressure of the safety valve

The set pressure of the safety valve shall be determined according to the following principles:

(1) The set pressure of the safety valve for the steam boiler is adjusted and calibrated according to those specified in Table 6-3; for the boiler with one safety valve installed, it is adjusted according to the lower set pressure in the table; and for the boiler with superheater installed, the safety valve on the superheater is adjusted according to the lower set pressure so as to guarantee the safety valve on the superheater is opened firstly.

Table 6-3 Set Pressure of Safety Valve for the Steam Boiler

Rated Working Pressure (MPa)	Set pressure of the safety valve	
	Minimum value	Maximum value
$p \leq 0.8$	Working pressure plus 0.03MPa	Working pressure plus 0.05MPa
$0.8 < p \leq 5.9$	1.04 times of the working pressure	1.06 times of the working pressure
$p > 5.9$	1.05 times of the working pressure	1.08 times of the working pressure

Note 6-2: The working pressure in Table 6-3 is referred to the working pressure at the installation site of the safety valve while is the working pressure at the control source extended site with regard to the controlled safety valve.

(2) For the once-through steam boiler, the maximum set pressure of the safety valve for the superheater system is less than or equal to 1.1 times of the working pressure of the superheater at the installation site.

(3) The set pressure of the safety valve for the reheater and external start-up (steam-water) separator of the once-through steam boiler is 1.1 times of the working pressure at the installation site.

(4) The pressure of the safety valve for the hot-water boiler is set or calibrated according to that specified in Table 6-4;

Table 6-4 Set Pressure of Safety Valve for the Hot-water Boiler

Minimum value	Maximum value
1.10 times of the working pressure but no less than the working pressure plus 0.07MPa	1.12 times of the working pressure but no less than the working pressure plus 0.10MPa

(5) When the stop valve is installed between the two-level connecting pipeline of the superheated steam system for the once-through steam boiler, the set pressure of the safety valve in front of the stop valve is set according to the maximum set pressure of the safety valve at the superheated steam system outlet.

6.1.10 Difference between the set and retreating pressures of the safety valve

Generally, the difference shall be 4% ~ 7% of the set pressure and the maximum shall not exceed 10% of the set pressure. When the set pressure is less than 0.3MPa, the maximum difference is 0.03MPa.

6.1.11 Installation of safety valve

(1) The safety valve shall be installed vertically at the highest position of the drum (shell) and header; pipeline and valve for taking steam or hot water shall not be installed between the safety valve and the drum (shell) or between the safety valve and the header;

(2) If several safety valves are installed together at a short pipe that is directly connected with the drum (shell), the flow sectional area of the short pipe shall be no less than the sum of the flow sectional areas of all safety valves.

(3) When the threaded-connection spring safety valve is adopted, the requirements specified in "Safety Valves - General Requirements" (GB/T 12241) shall be met. The safety valve shall be connected with the short pipe with threads while the welded structure shall be adopted to connect the short pipe with the drum (shell) or the header drum.

6.1.12 Devices on the safety valve

6.1.12.1 Basic requirements

(1) The direct-loaded safety valve shall be provided with a device to prevent the weight piece from flying off;

(2) The spring-loaded safety valve shall be provided with a lifting handle and a device to prevent the screw from adjustment by random twisting;

(3) Deadweight safety valve shall be provided with a device to prevent the heavy punch from moving automatically and a guide bracket to prevent the lever moving out.

6.1.12.2 Controlled safety valve

The controlled safety valve shall be provided with reliable power source and electrical supply, and meet the following requirements:

(1) Impulse from the pulsed safety valve shall be connected to the valve on the duct and it shall be kept fully open with lead-seal.

(2) The safety valve controlled by compressed air shall be provided with reliable air supply and electrical supply;

(3) The hydraulic controlled safety valve shall be provided with reliable hydraulic transfer system and electrical supply;

(4) The electromagnetic controlled safety valve shall be provided with reliable electrical supply.

6.1.13 Discharge pipe of safety valve for the steam boiler

(1) The discharge pipe shall be directly led to the safe location with sufficient flow sectional area so as to ensure free discharge and shall be fixed simultaneously; and the safety valve shall be free from any external force from the discharge pipe.

(2) The drain pipe at the safe location shall be connected to the bottom of the discharge pipe of the safety valve and shall not be provided with valve.

(3) The discharge pipes of two separate safety valves shall not be connected;

(4) If the discharge pipe of the safety valve is equipped with a silencer, the structure shall be provided with sufficient flow sectional area and reliable drain device;

(5) If the discharge pipe arranged in open air is provided with a shield, the shield shall be installed without any interference in the normal operation and maintenance of the safety valve.

6.1.14 Drain pipe of the safety valve for the hot-water boiler

The safety valve of the hot-water boiler shall be installed with drain pipe (if the lever safety valve is adopted, the drain devices shall be added on both sides of the valve spool). The drain pipe shall be directly led to the safe location with sufficient drainage flow area so as to guarantee unblocked drainage. In addition, no valve shall be installed on the drain pipe and anti-freezing measures shall be provided.

6.1.15 Calibration of the safety valve

(1) As for the boiler in use, the safety valve shall be calibrated at least once every year and the calibration generally shall be carried out under the operating state of the boiler. When the on-site calibration is not available or after the safety valve is repaired, the safety valve may be calibrated on the calibration console.

(2) When the boiler is newly installed or after the safety valve is inspected, repaired and changed, the set pressure and tightness shall be calibrated;

(3) After the safety valve is calibrated, lock or lead-seal shall be added; the calibrated safety valve cannot be break, smash and impact during the handling or installation process.

(4) The control loop reliability test and opening performance test shall be respectively carried out for the controlled safety valve;

(5) The inspection results such as the set pressure and tightness of the safety valve shall be recorded on the boiler safety technology file.

6.1.16 Application of the safety valve during operation of the boiler

(1) During operation of the boiler, the discharge test shall be carried out for the safety valve periodically, and for the utility boiler, the test interval for the safety valve shall be less than or equal to a minor repair interval, and for the controlled safety valve, the users shall carry out periodical test for the control system;

(2) During operation of the boiler, the safety valve is forbidden to be disconnected randomly, the set pressure to be randomly increased or the safety valve to be brought into failure.

6.2 Pressure measuring device

6.2.1 Arrangement

The following parts of the boiler shall be installed with pressure gauges:

- (1) In the drum (shell) steam space for the steam boiler;
- (2) In front of the feedwater control valve;
- (3) At the economizer outlet;
- (4) Between the superheater outlet and the main steam valve;
- (5) At the reheater outlet/ inlet;
- (6) At the start-up (steam-water) separator or the outlet pipeline for the once-through steam boiler;
- (7) At the economizer inlet and at the outlets of the storage tank and circulating pump for the once-through steam boiler;
- (8) In front of the stop valve at the evaporating heating surface outlet of the once-through steam boiler (if the stop valve is installed);
- (9) On the drum (shell) of the hot-water boiler;
- (10) At the outlet of the inflow valve and at the inlet of the outflow valve for the hot-water boiler;
- (11) At the circulating water pump outlet/ inlet of the hot-water boiler;
- (12) At the oil pump inlet (return oil) and outlet of the ignition oil system for the oil-fired boiler and coal-fired boiler;
- (13) At the air supply inlet of the ignition gas system and at the back of the pressure maintaining valve (pressure control valve) of the gas valve set for the gas-fired boiler and coal-fired boiler.

6.2.2 Selection of the pressure gauge

Selection of the pressure gauge shall meet the following requirements:

- (1) The pressure gauge shall meet the requirements of corresponding technical standards;
- (2) The precision of the pressure gauge shall be greater than or equal to Class 2.5; and as for the Level A boiler, it shall be greater than or equal to Class 1.6;
- (3) The measuring range of the pressure gauge shall be selected according to the working pressure; generally, it is 1.5 times~3.0 times of the working pressure and two times of the working pressure is preferred for selection;
- (4) The dial size of the pressure gauge shall guarantee that the boiler operation personnel is able to see the indicated value clearly and the dial diameter shall be not less than 100mm.

6.2.3 Calibration of the pressure gauge

Before installing, the pressure gauge shall be calibrated, a red line indicating the working pressure shall be marked on the dial, and the date for next calibration shall be noted. In addition, lead-seal shall be added on the pressure gauge after the calibration.

6.2.4 Installation of the pressure gauge

Installation of the pressure gauge shall meet the following requirements:

- (1) The pressure gauge shall be installed at the place easy for observing and purging and shall avoid being affected by high temperature, frost and vibration;
- (2) The pressure gauge arranged in the boiler steam space shall be provided with water storage bent tube or other steam cooling measures; and the pressure gauge for the hot-water boiler shall also be provided with buffer bent tube and the inside diameter of the bent tube shall be greater than or equal to 10mm;
- (3) The three-way valve shall be installed between the pressure gauge and the bent tube so as to purge the piping and to change as well as calibrate the pressure gauge.

6.2.5 Disuse conditions of the pressure gauge

In case of any of the following conditions, the pressure gauge shall be disused:

- (1) As for the pressure gauge with limiting nail under no pressure condition, the hand fails to return to the limiting nail after rotation; as for the pressure gauge without limiting nail under no pressure condition, the value that the hand is away from the zero position exceeds the specified allowance error of the pressure gauge;
- (2) The coverage glass is broken or the dial scale is unclear;
- (3) The seal is damaged or is beyond the calibration period;
- (4) The gauge inside has leak or the hand is not stable;
- (5) Other defects that affects its accurate indicating.

6.3 Water level measuring and indicating & controlling devices

6.3.1 Arrangement

6.3.1.1 Basic requirements

At least two separate direct-reading water gauges shall be installed for each steam boiler drum (shell). For the boiler under one of the following conditions, one direct-reading water gauge is permissible to be installed:

- (1) The boiler is provided with the nominal capacity less than or equal to 0.5t/h;
- (2) The boiler is provided with the nominal capacity less than or equal to 2t/h and equipped with a set of reliable water level indicating and controlling device;
- (3) The boiler is installed with two separate remote water level measuring devices;
- (4) The boiler is the electrically heated.

6.3.1.2 Special requirements

- (1) Two separate direct-reading water gauges shall be installed for the drum at each pressure level of the multi-pressure level exhaust heat boiler;
- (2) The storage tank and start-up(steam-water)separator in the start-up system of the once-through steam boiler shall be installed with remote water level measuring devices respectively.

6.3.2 Structures and devices for the water gauge

(1) The water gauge shall be provided with clear marks to indicate the highest/ lowest safe water level and normal water level. The visual edge at the underpart of the water gauge shall be at least 50mm higher than the highest fire line and be at least 25mm lower than the lowest safe water level; and the visual edge at the upper part shall be at least 25mm higher than the highest safe water level.

(2) The glass tube water gauge shall be provided with the protective device which shall not interfere in observing the actual water level; and the inside diameter of the glass tube shall be greater than or equal to 8mm;

(3) The glass sheet (tube) and mica sheet are able to be purged and changed during the operation of the boiler;

(4) A group of water gauges that are composed of 2 and over 2 glass sheets or mica sheets are able to indicate the water level continuously;

(5) As for the valves between the water gauge/ water meter column and the drum (shell), the flow channel diameter shall be greater than or equal to 8mm. The inside diameter of the steam/water connecting pipe shall be greater than or equal to 18mm; and when the connecting pipe is over 500mm long or a bend exists, the inside diameter shall be properly amplifies so as to guarantee the water gauge is sensitive and accurate;

(6) The connecting pipe shall be as short as possible. If the connecting pipe is not arranged horizontally, condensate in the steam connecting pipe will be able to flow towards the water gauge and water in the water connecting pipe will be able to automatically flow towards the drum (shell);

(7) The water gauge shall be provided with blow-off valve which shall be connected to the blow-off tube at the safe location;

(8) The steam/ water connecting pipe between the water gauge/ water meter column and the drum (shell) shall be installed with valves and during the operation of the boiler, the valves shall be at the fully open. As for the boiler with the nominal capacity less than 0.5t/h, the steam/ water connecting pipe between the water gauge/ water meter column and the drum (shell) may not be installed with valves.

6.3.3 Installation

(1) The water gauge shall be installed at the place easy for observing. When the distance between the water gauge and the operation ground is greater than 6000mm, the remote water level measuring device or water level video monitoring system shall be installed;

(2) When a single or several remote water level measuring devices are used to monitor the boiler water level, the signal(s) shall be taken out separately. Two reliable remote water level measuring devices shall be installed in the boiler control room. And during the operation of the boiler, one direct-reading water gauge shall be guaranteed to work normally.

(3) When installing and commissioning are carried out for the subcritical boiler water gauge, the measuring error caused by the fluid density difference inside the water gauge and the drum shall be corrected.

6.4 Temperature measuring devices

6.4.1 Arrangement

The temperature measuring points shall be arranged at the corresponding positions of the boiler and the following temperatures shall be measured:

- (1) Feed water temperature of the steam boiler (feed water at the normal temperature excluded);
- (2) Outlet water temperature of the cast-iron economizer and the utility boiler economizer;
- (3) Reheater inlet/outlet steam temperature;
- (4) Steam temperature of the superheater outlet as well as the sectionalized superheater outlet at each grade;
- (5) Steam temperature in front/ at back of the desuperheater;
- (6) Fuel oil (light oil excluded) inlet oil temperature of the oil burner;
- (7) Air heater inlet/ outlet air temperature;
- (8) Inlet gas temperature of the boiler air heater;
- (9) Exhaust gas temperature;
- (10) Upper/lower wall temperature of the steam boiler drum under Level A high pressure or above (controlled circulation boiler excluded) and metal wall temperature of the superheater/ reheater coiled pipe;
- (11) Outlet gas temperature of the boiler furnace with a reheater;
- (12) Inlet/ outlet water temperature of the hot-water boiler;
- (13) Outlet metal wall temperature of the upper/ lower furnace water-cooled wall of the once-through steam boiler and wall temperature of storage tank of the start-up system.

The recordable temperature measuring instruments shall be installed at the superheater outlet and reheater outlet of the steam boiler as well as at hot-water boiler outlet with the rated thermal power larger than or equal to 7MW.

6.4.2 Measuring range of the temperature measuring instrument

The measuring range of the dial-type temperature measuring instrument for temperature measurement shall be selected according to the working temperature and it generally is 1.5 times~2 times of the working temperature.

6.5 Blowdown device and blow-off device

Installation of the blowdown device and blow-off device shall meet the following requirements:

(1) The blowdown valves are required to be installed on the water-ring and at the lowest positions of the water circulation system for the steam boiler drum (shell) and the vertical boiler; the quick-opening blowdown valve is adopted for Level B boiler or below. The nominal diameter of the blowdown valve is 20mm~65mm and the nominal diameter of the blowdown valve at the shell of the horizontal shell boiler is greater than or equal to 40mm;

(2) As for the steam boiler with nominal capacity greater than 1t/h and Level B hot-water boiler, two tandem valves (at least with one blowdown valve) are installed on the blowdown pipe and close to the outlet side of the blowdown piping;

(3) The blow-off valve is installed at the lowest position of the header (or piping) of the superheater system, reheater system and economizer system;

(4) The continuous blowdown device is installed for the drum of the steam boiler with a superheater;

(5) Each boiler is installed with separate blowdown pipes on which the number of bends shall be reduced to a minimum to guarantee unblocked blowdown as well as connection to the safe location or the blowdown expansion tank (flash tank). When the pressure blowdown expansion tank is adopted, the safety valve is required to be installed on it.

(6) When one main blowdown pipe is used for several boilers, it is not permissible that more than two boilers are blow down simultaneously;

(7) Threaded connection shall not be adopted for the boiler blowdown valve and blowdown pipe.

6.6 Safety protection devices

6.6.1 Basic requirements

(1) The steam boiler shall be installed with the high/ low water level alarm device (the high and low water level alarm signals shall be able to be distinguished); and for the boiler with nominal capacity larger than or equal to 2t/h, the low water level interlock protection device shall also be installed. The protection devices shall operate at the lowest safe water level at the latest;

(2) As for the boiler with nominal capacity larger than or equal to 6t/h, the steam overpressure alarm device and interlock protection device shall be installed. And the operation set value of the overpressure interlock protection device shall be less than the lower set pressure of the safety valve;

(3) Corresponding protective measures shall be taken for the boiler superheater and reheater according to the operation mode and automatic control condition of the unit as well as the superheater and reheater design structures so as to prevent the metal wall from overheating.

And the reheat steam system shall be arranged with emergency sprinkler system which is able to operate automatically;

(4) As for the boiler installed in the multistory or highrise building, each boiler shall be equipped with an overpressure (over temperature) interlock protection device and a low water level interlock protection device.

6.6.2 Controlled circulation steam boiler

The controlled circulation steam boiler shall be installed with the following protection device and interlock device;

- (1) Inlet/ outlet pressure difference protection device for the boiler water circulating pump;
- (2) Over temperature protection device for the water temperature inside the circulating pump motor;
- (3) Interlock devices for the outlet valve of the boiler water circulating pump as well as the pump.

6.6.3 Level A once-through boiler

Level A once-through boiler shall be installed with the following protection devices:

- (1) In any case, the alarm device shall be installed when the feed water flow is less than the start-up flow;
- (2) After the boiler operates under the full once-through state, the alarm device shall be installed when the intermediate point temperature in the working medium process exceeds the specified value;
- (3) When the water cutoff time for feedwater exceeds the specified time, the device used to cut off the boiler fuel supply automatically shall be installed;
- (4) The alarm device shall be installed when the metal temperature of the upper/ lower furnace water-cooled wall for the subcritical once-through boiler and above exceeds the specified value;
- (5) The protection device shall be installed when the water temperature inside the circulating pump motor of the once-through boiler with start-up circulation is subject to over temperature.

6.6.4 Circulating fluidized bed boiler

The circulating fluidized bed boiler shall be installed with air volume and fuel interlock protection device which is able to cut off the fuel supply when the fluidization air volume is less than the minimum fluidization air volume.

6.6.5 Suspension firing boiler

The suspension firing boiler shall be installed with the interlock device which has the following functions:

- (1) It will cut off all air supply and fuel supply automatically when all draught fans are subject to tripping;
- (2) It will cut off all fuel supply automatically when all draught fans are subject to tripping;
- (3) It will cut off all fuel supply automatically when the all primary fans in direct-firing pulverizing system are subject to tripping;
- (4) It will automatically cut off the fuel oil or gas supply when the pressure of the fuel oil and its atomized working medium and gas pressure are less than the specified value;

(5) It will cut off the fuel supply automatically when the hot-water boiler pressure drops to the point where evaporation takes place or when the water temperature rises higher than the specified value;

(6) It will cut off the fuel supply automatically when the circulating water pump of the hot-water boiler suddenly stops operating and the standby pump fails to start normally.

As for the boiler under Level A high pressure or above, the furnace high/low pressure interlock protection device shall also be installed in addition to meeting the above-mentioned (1) ~ (4) requirements.

6.6.6 Ignition control program and flame failure protection

The suspension firing boiler shall be installed with the ignition control program and flame failure protection device, and the following requirements shall also be met:

(1) During the ignition control process, before the ignition the total ventilation shall be no less than 3 times of the total capacity of the inlet flue from furnace to the chimney. The ventilation time is at least 20s for the shell boiler, once-through boiler and the once-through boiler which is not used for power generation. And the ventilation time for the water tube boiler is at least 60s and that for the utility boiler generally more than 3min;

(2) Generally, the ventilation per unit time is maintained as the total combustion air under the rated load while for the utility boiler it is maintained as 25%~40% of the total combustion air under the rated load;

(3) When the flame failure protection device operates, the fuel supply shall be guaranteed to automatically cut off; and for the Level A boiler sufficient purging shall also be carried out for the furnace and flue.

6.6.7 Safety time and start-up thermal power of the oil burner, gas burner and powdered coal boiler burner

6.6.7.1 Ignition and extinction safety time of the burner (see Note 6-3)

As for the boiler with oil, gas and pulverized coal as its fuels, its burner must guarantee that the ignition and extinction safety time is in accordance with those specified in Tables 6-5, 6-6 and 6-7.

Note 6-3: The ignition safety time is referred to as the time from the fuel entering the furnace and failing to ignite to the fuel quick cutoff device beginning to operate when the burner is started. The extinction safety time is referred to as the time from flame failure to the quick-cutoff device beginning to operate when the burner is started.

Table 6-5 Safety Time of Oil Burner

Rated oil quantity(kg/h)	Ignition safety time(s)	Extinction safety time(s)
≤30	≤10	≤1 (Note 6-4)
>30	≤5	≤1 (Note 6-4)

Note 6-4: If the kinematic viscosity of the fuel oil under 50℃ is greater than 20mm²/s, the value may be increased to 3s.

Table 6-6 Safety Time of Gas Burner

Ignition safety time(s)	Extinction safety time(s)
≤5	≤1

Table 6-7 Safety Time of Pulverized Coal Burner

Ignition safety time(s)	Extinction safety time(s)
-	≤5

6.6.7.2 Start-up thermal power of the burner

As for the boiler with oil or gas as fuel, the start-up thermal power shall be strictly restricted when the burner is ignited.

6.6.7.2.1 Start-up thermal power of oil-fired boiler burner

- (1) With the unit set rated oil (B_e) less than or equal to 100 kg/h, the oil burner may be directly ignited under the rated output thermal power;
- (2) With the unit set rated oil (B_e) greater than 100 kg/h, the oil burner may not be directly ignited under the rated output thermal power and its maximum allowable start-up flow (B_{smax}) is detailed in Table 6-8.

Table 6-8 Maximum Allowable Start-up Flow of Oil Burner

Unit set rated oil B_e (kg/h)	Maximum allowable start-up flow when the main burner is directly ignited at low oil level B_{smax} (kg/h)	Maximum allowable start-up flow when the ignition burner is ignited at low oil Level B_{smax} (kg/h)
$100 < B_e \leq 500$	$B_{smax} \leq 100$ Or $B_{smax} \leq 70\% B_e$	$B_{smax} \leq 100$
$B_e > 500$	$B_{smax} \leq 35\% B_e$	$B_{smax} \leq 50\% B_e$

6.6.7.2.2 Start-up thermal power of gas-fired boiler burner

- (1) With the unit set rated output thermal power less than or equal to 120kW, the gas burner may be directly ignited under rated output thermal power;
- (2) With the unit set rated output thermal power greater than 120kW, the start-up thermal power of the gas burner shall be less than or equal to 120kW or less than or equal to 20% of the rated output thermal power.

6.6.8 Other safety requirements

- (1) In case of main fuel system tripping caused by accidents, the supplemental purging shall be carried out as soon as possible for the furnace which fails to be purged timely after flameout; and no fuel shall be supplies into the boiler furnace when the boiler has already been subject to flameout and shutdown.
- (2) During the operation of the boiler, the interlock protection device shall not be out of service randomly and its standby power supply or air supply shall be reliable and not be free from standby randomly. In addition, the automatic switch-in test shall be periodically carried out for the standby power supply or air supply;
- (3) The electrical element of the electric boiler shall be provided with reliable electrical insulation performance and sufficient electrical compression strength.

6.7 Other requirements of the electric boiler

As for the electric boiler designed and manufactured according to the corresponding standard of pressure vessels, its safety accessories shall meet the arrangement provisions and requirements specified in this Regulation.

7 Combustion Equipment, Auxiliary Equipment and System

7.1 Basic requirements

The combustion equipment, auxiliary equipment and system of the boiler shall be arranged in accordance with the model and specification of boiler, meet the requirements of the boiler's safe and economical operation, and be possessed of good environmental protection characteristics.

7.2 Combustion equipment and system

(1) As far as the boiler combustion system is concerned, the boiler combustion mode, furnace type, combustion equipment and fuel preparation system shall be selected properly according to the boiler design fuel.

(2) The oil-fired (gas-fired) boiler burner shall meet the requirements specified in "Safety Technical Rules for Oil (Gas) burner" (TSG ZB 001) and its type test shall be carried out according to the requirements specified in "Type Test Rules for Oil (Gas) burner" (TSG ZB 002). And the quality certificate for the type test is required before it is put into service.

(3) In front of the main control valve on the fuel supply main pipe of the oil (gas) burner, the manual rapid cut-off valve shall be installed at the position which is safe and convenient for operation.

(4) As for the boiler with gas system, the interlocking blow off valve group shall be arranged on the gas supply main pipeline in front of the boiler;

(5) As for the boiler with fuel gases such as blast furnace gas and coke oven gas for firing, its gas system is required to be provided with online monitoring device for gasses like carbon monoxide. And the gas system shall be designed in accordance with the relevant safety provisions in corresponding national and professional standards.

(6) Pulverized coal fired boiler shall be provided with the ignition device which is energy saving and high-efficient with reliable performance. And the ignition device shall be possessed of the ignition energy matching with the coal type;

(7) At the filling inlet in front of the circulating fluidized bed boiler furnace, strict sealing measures shall be provided. When the circulating fluidized bed boiler is started, proper bed material shall be selected and the hearth shall be free from coking.

7.3 Coal pulverizing system

(1) The actual velocity of the air-pulverized coal mixture in the pulverized coal pipeline, when the boiler is subject to any load, will never be greater than or equal to the minimum velocity at which pulverized coal settles in the pipeline;

(2) Among the pulverized coal pipelines at the same coal mill outlet in the coal pulverizing system, there shall be favorable distribution characteristics of air-pulverized coal,

and the too large deviation shall be avoided among the burners (or pulverized coal feeding pipes);

(3) The coal pulverizing system of the pulverized coal fired boiler shall comply with the relevant requirements to prevent the coal pulverizing system from explosion that are specified in corresponding regulations and standards such as "Technical Code for Explosion Prevention Design of Coal and Pulverized Coal Preparation System of Fossil Fuel Power Plant" (DL/T 5203).

7.4 Steam and water system

(1) The boiler feedwater system shall guarantee reliable water supply for boilers. The arrangement of the feedwater system as well as capacity and number of the feedwater equipment will be determined according to the design specifications;

(2) The steam boiler with nominal capacity greater than 4 t/h shall be provided with the automatical feedwater regulating device and the manual control feedwater device shall be installed at the position which is convenient for the boiler operation personnel to operate;

(3) The boilers with different working pressures shall be provided with separate steam pipeline and feedwater pipeline respectively. If the same steam main pipe is adopted, the steam pipeline under higher pressure shall be provided with an automatical decompressor and the steam pipeline under lower pressure shall be provided with check valve to prevent overpressure. When the feedwater pressure difference is less than 20% of the maximum working pressure, the general feedwater system may be used to carry out feedwater for the boiler.

(4) The circulating fluidized bed boiler with an external heat exchanger shall be arranged with emergency make-up water system;

(5) The check valve and block valve shall be set at the feedwater pump outlet. The feedwater check valve shall be installed between the feedwater pump and the feedwater block valve and shall be closely connected with the feedwater block valve. The monoblock unit economizer may not be installed with block valve and check valve at the inlet. For the header type feedwater system, the economizer inlet of each boiler shall be installed with block valve and check valve; and the cast-iron economizer shall also be installed with block valve and check valve at its outlet;

(6) The main steam valve shall be installed at the outlet close to the drum (shell) or the superheater header. As for the monoblock unit boiler, the main steam valve may be installed at the steam turbine inlet and for the vertical shell boiler, it may be installed at the position in the boiler house which is easy for operation. When several boilers are in parallel operation, two block valves shall be installed on each steam pipe (connected with the boiler) of the steam main pipe. The drain pipe and the drain valve with inside diameter no less than 18mm that can lead to air shall be installed between the two block valves. In addition, the steam discharge pipe and

corresponding valve shall be installed between the boiler outlet and the first block valve (main steam valve);

(7) As for the utility boiler under Level A high pressure or above, when the bypass system that may be used for steam recovery is not arranged, the remote control dump steam atmospheric valve (or power-driven relief valve)shall be installed;

(8) At the positions of the drum (shell), superheater, reheater and economizer where air is able to accumulate, the exhaust valve shall be installed.

7.5 Treatment system of boiler water

(1) The treatment system of the boiler water shall be designed according to the boiler type, parameter as well as the requirements for steam and water qualities; and it shall satisfy the needs for the boiler water supply and water quality regulation. As for the industrial boiler, the water treatment design shall be in accordance with the "Design Code for Softening and Demineralization of Industrial Water" (GB/T 50109) and for the utility boiler, it shall be in accordance with the relevant provisions specified in "Technical Code for Designing Chemistry of Fossil Fuel Power Plants " (DL/T 5068);

(2) The boiler under Level A high pressure or above shall be equipped with on-line chemical monitoring instrument to continuously monitor the steam and water qualities according to the boiler type, parameter and the requirements for chemical supervision;

(3) The water treatment equipment manufacturing quality shall meet the relevant rules of the national and professional standards. Commissioning for the water treatment equipment shall be carried out according to the relevant technical requirement and the outflow quality and equipment output shall meet the design requirements.

7.6 Pipeline valve and air-flue gas damper

(1) When one main flue is used for several boilers, the flue damper with a reliable limit device shall be installed inside the bypass flue of each boiler;

(2) The valve and air-flue gas system damper on the boiler pipeline all shall be provided with clear signs which indicate the names, serial number, the switch direction and medium flow direction of the valve and damper. And the main regulating valve shall also be provided with opening indication;

(3) All valve and damper operating mechanism shall be installed at the position which is easy for operation.

8 Service Management

8.1 Basic requirements

8.1.1 Service registration

Before the boiler is put into service or within 30 days after the boiler is put into service, the boiler user shall undergo the register as required for each boiler to the quality and technical supervision department.

8.1.2 Safety technology files of the boiler

The boiler user shall establish safety technology files for each boiler, which at least include the following details:

- (1) The delivery technical document and supervisory inspection certificate of the boiler;
- (2) Technical information of the boiler installation, alteration and repair as well as the supervisory inspection certificate;
- (3) Technical information of the installation and commissioning for water treatment equipment;
- (4) The periodic inspection report of the boiler;
- (5) The daily service status record of the boiler;
- (6) The daily maintenance records of the boiler and its safety accessories, safety protection devices and measuring control devices;
- (7) The operation failure and accident records of the boiler.

8.1.3 Safety management personnel and operation personnel

The boiler safety management personnel and operation personnel as well as the boiler water treatment operation personnel shall take the post with certificate by complying with the provisions specified in "Supervision and Administration Measures for the Operation Personnel of Special Equipment" issued by the AQSIQ and work in accordance with the related rules.

The Level B full-automatic boiler or below may not be equipped with the attendant operation personnel but a periodical patrol inspection system shall be established.

8.1.4 The boiler service management system

The boiler service management shall be provided with the following systems and specifications:

- (1) The post responsibility system, including the assignments and requirements within the responsibility scope for the boiler safety management personnel, shift leader, operation personnel, maintenance personnel and the water treatment operation personnel;
- (2) The patrol inspection system, explicitly indicating the content, process and record items of periodic inspection;
- (3) The shift relief system, explicitly indicating the handover requirements, inspection content and handover procedure;
- (4) The operation specifications for the boiler and auxiliary equipment, including the inspection and preparation before the equipment is put into operation, operating methods of start-up and normal operation as well as the operating methods of normal shutdown and emergency shutdown;
- (5) The equipment maintenance system, specifying the corrosion-resistant details and requirements for the shutdown (standby) boiler as well as the maintenance periods, details

and requirements for the boiler proper, safety accessories, safety protection devices, automatic instrument and combustion & auxiliary equipment;

(6) The water (medium) management system, explicitly indicating the periodical testing items and acceptance criteria for the water (medium);

(7) The safety management system, explicitly indicating fire protection and anti-explosion requirements as well as the requirements that forbid the non-operation personnel to enter the boiler house randomly; the measures that guarantee the unhampered access; and the accident emergency plan and accident handling measures;

(8) The energy-saving management system, complying with the relevant safety technical codes on the boiler energy-saving management.

8.1.5 Service management records of the boiler

(1) The operation records for the boiler and combustion & auxiliary equipment;

(2) The operation record for the water treatment equipment and chemical testing record for the steam & water quality;

(3) The handover record;

(4) The maintenance records for the boiler and combustion & auxiliary equipment;

(5) The inspection records for the boiler and combustion & auxiliary equipment;

(6) The operation failure and accident records for the boiler;

(7) The boiler preservation record.

8.1.6 Safe operation requirements

(1) Before the boiler operates, the boiler operation personnel shall well carry out various examinations, start and operate the boiler according to the established procedures and is forbidden to raise the operation parameter at will. After the banking, the boiler water temperature and the pressure shall be guaranteed without picking up and the boiler without water shortage;

(2) During the operation of the boiler, when the pressure part is subject to leakage, the furnace suffers severe coking, the slag-tap boiler is unable to slag off, the boiler back-end flue is subject to severe ash-blocking, the furnace wall is burnt red, metal on the heating surface suffers severe overheat, and the steam and water qualities deteriorate seriously, the boiler shall be out of operation.

8.1.7 Immediate shutdown conditions for the steam boiler (utility boiler excluded)

In operation of the steam boiler (utility boiler excluded), in case of any of the following conditions, the boiler shall be shutdown immediately:

(1) When the boiler water level is below the lowest visual edge of the water gauge;

(2) When the water level still continues to decline even though the feedwater is continuously increased and other measures are taken;

(3) When the boiler is provided with full water, and the water level is beyond the highest visual water level, but the water level is still cannot be observed through discharging;

(4) Water cannot be fed into the boiler due to the feedwater pump fails to work or the feedwater system is subject to failure;

(5) When the water gauge, safety valve or pressure gauge installed in steam space all fail to work;

(6) When the boiler pressure parts are damaged, which will jeopardize the boiler operation personnel;

(7) When the combustion equipment is damaged, the furnace wall collapses or the boiler structure is burnt red, which will seriously imperil the safe operation of the boiler;

(8) When other abnormal conditions that will imperil the safe operation of the boiler happen.

8.1.8 Safety requirements of the boiler inspection and repair

When inspection and repair are required to be carried out inside the boiler, the following requirements shall be met:

(1) Before entering the drum (shell) to work, the metal blind with sufficient strength(the valve may be used for the utility boiler)that is able to indicate the isolation position will be used to reliably isolate the piping that is connected with other operating boilers such as the steam pipeline, hot water pipeline, feedwater pipeline and blowdown pipeline. As for the boiler with oil or gas as fuel, the oil supply and gas supply must be reliably isolated;

(2) Before entering the drum (shell) to work, the manhole on the drum (shell) and handhole on the header must be opened for air convection for some time; and during the inspection and repair, personnel is required to carry out monitoring outside the boiler;

(3) Before entering the flue and furnace to work, ventilating must be conducted and they must be reliably isolated from the main flue or flues of other operating boilers;

(4) When the lamp is used for illumination during working inside the drum (shell) and wet furnace and flue, the illumination voltage shall be less than or equal to 24V; when working inside the dryer flue with appropriate safety measures, the illumination voltage may be less than or equal to 36V; and the open flame is forbidden to be used for illumination.

8.1.9 Boiler water(medium) treatment

8.1.9.1 Basic requirements

The users shall carry out the water treatment according to the provisions in the "Boiler Water (Medium) Treatment Supervision Administration Regulation" (TSG G 5001) so as to guarantee the steam and water qualities. Without reliable water treatment measures, the boiler shall not be put into operation.

The operation of the water treatment system shall meet the following requirements:

(1) The water treatment equipment and dosing device are guaranteed to operate normally, so that qualified make-up water is able to be provided for the boiler continuously;

(2) Necessary testing measures are adopted to monitor the steam and water qualities, so that the security risks are able to be discovered and eliminated timely;

(3) The water qualities of the drain and production return water are strictly controlled, and they cannot be recycled into the boiler if unqualified.

8.1.9.2 Steam & water quality standards of the boiler

As for the industrial boiler, the water quality shall meet the provisions in "Water Quality for Industrial Boilers" (GB/T 1576). As for the utility boiler, the steam and water qualities shall conform to the provisions in "Quality Criterion of Water and Steam for Generating Unit and Steam Power Equipment" (GB/T 12145) or those specified in "Quality Criterion of Water and Steam for Supercritical Pressure Units in Fossil Fuel Power Plant" (DL/T 912).

8.1.10 Boiler blowdown

The boiler user shall determine the blowdown methods and blowdown quantity according to the boiler water quality and make adjustment according to the water quality change. As for the steam boiler, the periodic blowdown shall be carried out under low-load and the water level shall be strictly monitored simultaneously.

8.1.11 Boiler chemical cleaning

The boiler user shall arrange the chemical cleaning timely according to the relevant provisions. The unit engages in boiler cleaning shall carry out cleaning according to requirements of the safety technical code and accept the supervisory inspection for the boiler cleaning process implemented by the special equipment inspection institute.

8.1.12 Preservation for shutdown (standby) boiler and water treatment equipment

The boiler user shall conduct the preservation work like anti-corrosion for the shutdown (standby) boiler and water treatment equipment.

8.1.13 Accident prevention and emergency rescue of the boiler

The boiler user shall make the accident emergency measures and rescue plans, which include organization plan, responsibility system, alarm system and implementation plan for emergency rescue under emergency situation.

8.1.14 Accident report and handling of the boiler

When the boiler accident happens, the boiler user shall timely report and handle according to "Accident Report, Investigation and Handling Provisions for Special Equipment".

8.2 Special requirements for the utility boiler

8.2.1 Safety technology file of the utility boiler

After the overall acceptance is acceptable, the boiler installation unit shall timely transfer the technical information for the main steam pipeline, main feed water pipeline and reheat steam pipe as well as their support & hanger and weld position to the user to be kept in the safety technology files. In addition, the user shall make good records related to operation, inspection, alteration, repair and accident of the piping and valves.

8.2.2 Fuel management for the utility boiler

The user of the utility boiler shall strengthen fuel management. The coal quality for the boiler shall basically meet the design requirement. The fuel analysis shall be carried out before the fuel is put into the furnace and the combustion control and adjustment shall be carried out according to the analysis result. In case of the coal quality with a relatively big design deviation, combustion adjustment test shall be conducted.

8.2.3 Start-up and shutdown of the utility boiler

(1) The user of the utility boiler shall determine the boiler start-up and shutdown modes according to the relevant material and equipment structure characteristics provided by the manufacturer or by means of testing, and draw the boiler control (start/stop) curve;

(2) At the early start-up stage of the utility boiler, the boiler fuel and furnace outlet gas temperature shall be controlled so as to make the temperature rise and pressure boosting processes match with the start-up curves. In the start/stop process of the boiler, special attention shall be paid to the expansion conditions of all parts of the boiler and expansion indication records shall be made. In addition, all parts shall be subject to uniform expansion and the drum wall temperature difference shall be monitored;

(3) When the utility boiler is shutdown, the cooling and pressure reduction processes shall match with the shutdown curves. The ventilating and water-discharging after the flame failure shall make the pressure parts avoid quick cooling. After the boiler is shutdown, when the pressure fails to reduce to the atmospheric pressure and the exhaust gas temperature fails to drop below 60°C, the boiler shall be monitored closely.

8.2.4 Immediate shutdown conditions for the utility boiler

During the operation of the utility boiler, in case of the following conditions, the fuel

supply shall be stopped and the boiler shall be immediately shutdown:

- (1) When the boiler is subject to severe water shortage;
- (2) When the boiler is subject to severe full water;
- (2) When the once-through boiler is subject to water cutoff;
- (3) When the boiler water circulating pump suffers failure and cannot guarantee the safe operation of the boiler;
- (4) When the water level device fails to monitor the water level;
- (5) When the main steam pipe, reheat steam pipe, main feed water pipe and the connecting pipeline within the range of the boiler blasts;
- (6) When the steam of reheater is cutoff (excluding the condition specified by the manufacturer);
- (7) When the furnace is subject to flame failure;
- (8) When the oil (gas) pressure for the oil-fired (gas-fired) boiler drops seriously;
- (9) When all safety valves fail to work or the boiler is subject to overpressure;
- (10) When the thermal instrumentation fails to work, the control power (gas) supply is interrupted and the main operation parameters are unable to be monitored and adjusted;
- (12) When other conditions take place like seriously endangering the personal & equipment safety and the condition particularly specified by the manufacturer.

8.2.5 Treatment of abnormal boiler steam and water qualities

When the boiler steam and water qualities are abnormal, it shall be treated according to the tertiary treatment principles of abnormal water and steam specified in "Quality Criterion of Water and Steam for Generating Unit and Steam Power Equipment" (GB/T 12145) or in "Quality Criterion of Water and Steam for Supercritical Pressure Units in Fossil Fuel Power Plant" (DL/T 912), record for abnormal conditions shall be made; and the causes shall be found out as soon as possible so as to eliminate the defects for normal conditions. If it fails to return to the normal condition and imperils the equipment safety, measures shall be immediately taken until the operation is stopped.

8.2.6 Chemical examination during the boiler inspection and repair

As far as the chemical examination during the boiler inspection and repair is concerned, the boiler user shall, according to the "Guide for Chemistry Check-up of Unit Maintenance in Fossil Fuel Power Plant" (DL/T 1115), carry out examination and assessment on conditions such as corrosion, scaling and salification for the parts of the boiler like economizer, drum, start-up (steam and water) separator, water-cooled wall, superheater and reheater.

9 Inspection

9.1 Inspection institute and personnel

Inspection institute shall engage in the inspection in strict accordance with the approved scope, and the inspectors shall have the appropriate special equipment inspection personnel certificate.

9.2 Manufacture supervisory inspection

9.2.1 Basic requirements

Supervisory inspection shall be carried out by the inspection institute for the manufacture of boilers and pressure parts according to relevant safety technical regulations, those not being qualified in the supervision and inspection shall not be delivered and put into service.

9.2.2 Supervisory inspection items

Manufacture supervisory inspection items cover the supervisory inspection for operation condition of quality assurance system during manufacturing of the boiler manufacturer and that for items involving safety performance during manufacturing of boilers. The supervisory inspection covers at least the following items:

- (1) Random inspection for manufacturer resource conditions and operation condition of quality assurance system;
- (2) Verification for appraisal data of boiler design document
- (3) Supervision, verification and random inspection for manufacturing process of boilers;
- (4) Random inspection for forming quality of boilers;
- (5) Check and review for technical information of boiler delivery.

9.2.3 Supervisory inspection certificate

Supervisory inspection certificate will be issued for boilers whose randomly inspected items are in accordance with the requirements of relevant laws and standards in manufacture supervisory inspection.

9.3 Supervisory inspection for installation, alteration and important repair

9.3.1 Basic requirements

Supervisory inspection shall be carried out by the inspection institute for installation, alteration and important repair process of boilers according to relevant safety technical regulations, those not being qualified in the supervisory inspection shall not be delivered and put into service.

9.3.2 Supervisory inspection items

Supervisory inspection for installation, alteration and important repair of boilers cover that for items involving safety performance in the process of installation, alteration and important repair of boilers and that for operation condition of quality assurance system of client. The supervisory inspection shall cover at least the following items:

- (1) Inspection for resource allocation at the construction site of installation, alteration and important repair units;
- (2) Check and review of the construction process document for installation, alteration and important repair;
- (3) Random inspection for boilers and their delivery information;
- (4) Random inspection for implementation condition of quality assurance system in the process of installation, alteration and important repair for boilers;
- (5) Random inspection for quality of installation, alteration and important repair of boilers;
- (6) Verification for safety accessories, protective devices and commissioning conditions;
- (7) Verification for water treatment system and commissioning conditions of boilers.

9.3.3 Supervisory inspection certificate

Supervisory inspection certificate will be issued for boilers whose randomly inspected items are in accordance with the requirements of relevant laws and standards in supervisory inspection.

9.4 Periodical inspection

9.4.1 Basic requirements

(1) Periodical inspection of boilers covers external inspection in boilers operation, internal inspection and hydraulic (pressure) test in boilers shutdown;

(2) User of boilers shall arrange for the periodical inspection, in addition, the user shall apply to the inspection institute for periodical inspection one month before the next inspection date of boilers, and the inspection institute shall make an inspection scheme.

9.4.2 Period of periodical inspection

Period of periodical inspection for boilers is specified as follows:

(1) External inspection: it is carried out annually;

(2) Internal inspection: it is carried out for boilers once in every two years; that for boilers in complete device is carried out in combination with the inspection and repair period of the complete device; that for utility boilers is carried out once in every 3~6 years together with the inspection and repair of boilers; the first internal inspection is carried out one year after the boiler is put into operation; and that for boilers in complete device and utility boilers is carried out in combination with the first inspection and repair.

(3) Hydraulic (pressure) test: in case of doubt on safety state of equipment by inspector or user, hydraulic (pressure) test shall be carried out; where internal inspection cannot be carried out due to the boiler's structure, the hydraulic (pressure) test shall be carried out once in every 3 years.

If periodical inspection cannot be carried out on time due to repair period of boilers in complete device and utility boilers, the user of boilers may postpone the inspection period and meanwhile file with the quality and technical supervision department in the registration location after it is approved by the technical principal of user under the premise that safe operation (or out of service) of boilers are guaranteed.

9.4.3 Special situations for periodical inspection

Except normal periodical inspection, internal inspection shall also be carried out for boilers in case of any of the following conditions:

(1) Before putting into operation of transferred boilers;

(2) Before returning to operation of a boiler which has been out of service for more than a year.

9.4.4 Order of periodical inspection items

When external inspection, internal inspection and hydraulic (pressure) test are carried out in the same year, internal inspection is generally carried out at first followed by hydraulic (pressure) test and external inspection.

9.4.5 Technical preparation before periodical inspection

(1) Check and review for technical information and operation record of boilers;

(2) Inspection institutes compile inspection scheme according to actual conditions of boilers to be inspected;

(3) Inspector shall inform boiler users to make good preparation for the inspection before entering the boiler. Preparation of the equipment shall be in accordance with the requirements of Article 8.1.8 in this Regulation and those specified in the corresponding regulations and standards.

(4) User of boilers shall do some assistant jobs according to the requirements of the inspection.

9.4.6 Internal inspection items

(1) Check and review for the rectification conditions of problems found in the previous

inspection;

- (2) Random inspection for the pressure part and its internal devices;
- (3) Random inspection for accessory equipment such as combustor, combustion equipment, soot blower and flue;
- (4) Random inspection for main carrying, hanger, support and fastener;
- (5) Random inspection for expansion condition;
- (6) Random inspection for sealing and insulation conditions.

9.4.7 External inspection items

- (1) Check and review for the rectification conditions of problems found in the previous inspection;
- (2) Verification for service registration of boiler and qualification of its operation personnel;
- (3) Random inspection for safety management system of boiler and its implementation verification information;
- (4) Random inspection for operation conditions of boiler proper and accessory equipment;
- (5) Random inspection for commissioning conditions of safety accessories as well as interlocking and protection;
- (6) Random inspection for treatment conditions of water (medium);
- (7) Random inspection for safety state of boiler operating space;
- (8) Check and review for emergency special-plan of boiler accident.

9.4.8 The timing for performing external inspection of boiler

External inspection may affect normal operation of boiler. The inspection institute shall negotiate with the user for the inspection time in advance, and carry out inspection under the assistance of user in operation; moreover, it shall not endanger safe operation of the boiler.

9.4.9 Hydraulic (pressure) test

Hydraulic (pressure) test shall meet the relevant requirements of Chapters 4 and 5 in this Regulation.

When the maximum working pressure actually used is lower than the rated working pressure of boiler, the test pressure may be determined according to the maximum working pressure provided by the user of the boiler; however, when the user of the boiler needs to increase the adopted working pressure (it shall not exceed the rated working pressure), the test pressure shall be re-determined according to the increased one so as to carry out hydraulic (pressure) test.

9.4.10 Defect treatment

Defects found during the inspection shall be treated according to the fitness-for-purpose criteria;

- (1) The defects are analyzed for its nature, position and hazard degree for safe and economical operation of boiler, so that whether the defects shall be eliminated is determined.
- (2) For the treatment of significant defects, the user shall organize safety assessment or expert appraisal so as to determine the treatment method of defect; if alteration and important repair are required, it shall be carried out according to the requirements of Chapter 5 in this Regulation.

9.4.11 Inspection conclusion

9.4.11.1 Internal and external inspection conclusions

- (1) The boiler is in accordance with the requirements, no problem affecting safe operation of boiler is found or rectification of the problem is qualified.
- (2) The boiler is basically in accordance with the requirements. Problem affecting safe running of the boiler is found and measures such as reducing parameters, shortening inspection period or strengthening monitoring for major problems are required to taken.

(3) The boiler is not in accordance with the requirements, and problems affecting safe operation of boiler are found.

9.4.11.2 Hydraulic (pressure) test conclusion

(1) The boiler is acceptable and in accordance with the requirements of Article 4.5.6.4 in this Regulation;

(2) The boiler is rejected and not in accordance with the requirements of Article 4.5.6.4 in this Regulation;

10 Hot-water Boiler and System

10.1 Design

- (1) Rated working pressure of boiler shall be greater than or equal to the corresponding saturation pressure at temperature 20°C higher than the rated outlet water temperature.
- (2) Structure of boiler shall guarantee normal water circulation in circulation circuit, all heating surface shall be reliably cooled, and be able to avoid evaporization.
- (3) Designer and manufacturer of shell-type horizontal externally-fired boiler shall adopt technical measures to solve problems such as tube sheet cracks or leak as well as shell bulge.

10.2 Discharge device

- (1) Outlet pipe of boiler is generally arranged at the topmost of boiler; and gas extractor shall be arranged at the topmost of outlet pipe in front of outlet pipe. Relief valve with nominal diameter greater than or equal to 20mm shall be arranged at the topmost of each circuit and boiler drum (shell) or outlet pipe. Exhaust pipe at the topmost of each boiler circuit shall be centrally arranged.
- (2) Drain pipe shall be arranged on the outlet pipe or the topmost of the boiler drum (shell), its inner diameter shall be determined according to the rated thermal power of the boiler, and it shall be greater than or equal to 25mm. Relief valve shall be arranged on the drain pipe, when the boiler is under normal operation, the relief valve is closed. For boiler arranged with relief valve, its boiler drum (shell) or outlet pipe may not be arranged with relief valve;
- (3) Blowdown valve or water drain valve shall be arranged in boiler drum (shell) as well as the lowest position of header under circulation circuit.

10.3 Protective device

- (1) For Level B boiler as well as Level C boiler with rated thermal power larger than or equal to 7MW, overheat alarm device and interlock protection device shall be provided;
- (2) For grate firing boiler, devices which can automatically stop air blast and induction shall be provided when pressure of the boiler reduces to the degree that evaporization happens or the water temperature exceeds the specified value and the circulating water pump stops working.

10.4 Hot water system

Design of the hot water system shall meet the requirements of "Code for Design of Boiler Plant" (GB 50041) as well as the following ones:

- (1) Gas extractor shall be set at the topmost of the hot water system and at the position easy for gas collection, and moreover, reliable constant pressure measures and expansion device of circulating water shall be provided with;
- (2) Hot water system shall be arranged with automatic make-up water device, and manually controlled make-up water device shall be set at positions convenient for operation of personnel;

(3) Forced circulated hot water system shall be provided with at least 2 circulating water pumps, when one of them stops working, total flow of the rest pump shall meet the requirement of the maximum circulating water;

(4) Bypass pipe with check valve shall be set between pipelines before and after the circulating water pump, or other measures shall be taken for avoiding water hammer due to suddenly shutoff of pump.

(5) Dirt separator shall be set on return main of hot water system, which shall be installed on the place easy for operation and shall be cleaned periodically.

10.5 Service

10.5.1 Operating order of boiler

When a boiler is put into operation, its circulating pump shall be started at first, and boiler temperature can be increased only after the water circulation of heating system gets normal. When the boiler is shutdown, the pump shall not be shut down immediately, and only after the outlet water temperature drops below 50°C, can it be shutdown. When the boiler is presented with evaporization and restart is required, its restart shall be carried out after the steam is released and water is supplied, and then the circulating water pump shall be restarted.

10.5.2 Power off protection

Boiler users shall develop protection measures for avoiding boiler water evaporization at suddenly power off.

10.5.3 Boiler blowdown

Time interval as well as volume of boiler blowdown shall be determined according to the operating conditions and the water quality analysis report. Boiler pressure shall be monitored during blowdown so as to avoid evaporization.

10.5.4 Conditions for immediate shutdown of boiler

In case of one of the following conditions in operating of a boiler, the boiler shall be immediately shutdown:

- (1) The water circulation is not smooth, or the outlet water temperature of the boiler rises with difference between it and the corresponding saturation temperature less than 20°C.
- (2) Boiler water temperature rises rapidly out of control;
- (3) Circulating water pumps or make-up water pumps fail;
- (4) Make-up water pump supplies water to the system continuously, and the boiler pressure is still reducing continuously;
- (5) Pressure gauge or safety valve fails;
- (6) Boiler parts (components) are damaged which will endanger the safety of boiler operating personnel.

- (7) Combustion equipment is damaged, furnace wall collapses, or boiler structure is burned to red, which seriously imperil safe operation of the boiler.
- (8) Other abnormal circumstances endangering safe operation of the boiler.

11 Organic Heat Transfer Material Boiler and System

11.1 Organic heat transfer material

11.1.1 Maximum allowable service temperature and product type test

The maximum allowable service temperature of organic heat transfer material product shall be determined according to its thermal stability, and the thermal stability shall be determined according to the methods specified in "Heat Transfer Fluids - Determination of Thermal Stability" (GB/T 23800).

Quality of heat transfer fluid product shall be in conformity with the regulations of "Heat Transfer Fluids" (GB 23971), and be qualified in the product type test which shall be carried out according to the requirements of "Boiler Water (Medium) Treatment Supervision Administration Regulation"(TSG G 5001).

11.1.2 Selection and service conditions

Selection and service of heat transfer fluid product shall conform to the provisions of "Safety Technology Conditions for Heat Transfer Fluids" (GB 24747), when no effective and reliable leakproof safety measures are taken, the organic heat transfer material shall not be used directly to heat or cool chemical products with oxygenization. Organic heat transfer material in service shall be at least inspected by sampling once a year.

11.1.3 Mixed service of different organic heat transfer materials

Gas-phase organic heat transfer material with different chemical compositions shall not be used in combination, and so are the gas-phase organic heat transfer material and the liquid phase one; and the synthetic liquid-phase organic heat transfer material shall not be used in combination with the mineral organic heat transfer material either.

11.1.4 Maximum working temperature

The maximum working temperature of organic heat transfer material shall not be higher than its spontaneous ignition temperature, and in addition it shall be at least lower than the maximum allowable service temperature 10℃. For coal-fired boiler or boiler with mean heat flux of radiant heating surface of furnace greater than 0.05 MW/m^2 , the maximum working temperature of organic heat transfer material shall be lower than 20℃ of the maximum allowable service temperature.

11.1.5 Maximum allowable liquid membrane temperature

When the maximum allowable service temperature of organic heat transfer material is lower than or equal to 320℃, the maximum allowable liquid membrane temperature shall not be higher than the sum of the maximum allowable service temperature plus 20℃; otherwise the maximum allowable liquid membrane temperature shall not be higher than the sum of maximum allowable service temperature plus 30℃.

11.2 Boiler

11.2.1 Design pressures of boiler and its accessory container

(1) The sum of rated working pressure plus 0.3MPa is taken as the design calculation pressure of boiler. For flame heating boiler, its design calculation pressure shall be greater than or equal to 1.0MPa; and for electric boiler and exhaust (waste) heat boiler, their design calculation pressure shall be greater than or equal to 0.6MPa.

(2) The minimum design calculation pressure of non-pressure-bearing container in organic heat transfer material system shall be 0.2MPa, and the design calculation pressure of the pressure-bearing container shall be at least the sum of its rated working pressure plus 0.2MPa.

11.2.2 Working pressure of forced circulation liquid-phase boiler using gas-phase organic heat transfer material

When forced circulation liquid phase boiler uses gas-phase organic heat transfer material, its working pressure shall be greater than the saturation pressure of corresponding organic heat transfer material under temperature 20°C higher than the maximum working temperature.

11.2.3 Arrangement for furnace tube of flame heating boiler

Arrangement for furnace tube of flame heating boiler shall insure that the organic heat transfer material in the boiler is heated uniformly, and the flame shall be avoided to directly contact with the heating surface.

11.2.4 Maximum heat flux of electric boiler

The maximum heat flux of metal sheath surface for electric heating element used by electric heater is generally less than or equal to 0.02 MW/m^2 . For electric heating element used by piping electric heater, its maximum heat flux on metal sheath surface may be properly increased under conditions of safe low temperature start-up.

11.2.5 Maximum liquid membrane temperature in calculation of boiler

The maximum liquid membrane temperature in calculation of boiler shall not exceed the maximum allowable liquid membrane temperature of organic heat transfer material selected. The boiler manufacturer shall provide the calculated results of the maximum liquid membrane temperature and the minimum restricted flow rate of boiler in its delivery information.

11.2.6 Capacity for organic heat transfer material of natural circulation gas phase boiler

For boiler used in natural circulation gas phase system, capacity of organic heat transfer material for evaporation above its minimum liquid level of drum can make the free space of the system full of steam shall be guaranteed in design.

11.2.7 Proof pressure test and gas tightness test

(1) For integrate marketable boiler, boiler component and on-site assembled boiler, hydrostatic test (or gas pressure test according to design requirement) shall be carried out according to 1.5 times of working pressure; for gas phase boiler adopting hydrostatic test, gas tightness test shall also be carried out according to the working pressure;

(2) Gas pressure test and gas tightness test of boiler shall meet the relevant technical requirements of "Supervision Regulation on Safety Technology for Stationary Pressure Vessel".

(3) Organic heat transfer material or water shall be adopted as the medium of the hydrostatic test; gas used in the gas pressure (tightness) test shall be dry and clean air, nitrogen or other inert gas; when organic heat transfer material is adopted as the test medium, gas tightness test shall be carried out before the hydrostatic test; and when water is adopted as the test medium, water left in the equipment shall be discharged clearly after the hydraulic test, and the equipment shall be dried with compressed air.

11.3 Safety accessories and instruments

11.3.1 Safety valve arrangement

11.3.1.1 Gas phase boiler and system

(1) At least two fall lift spring-loaded safety valves without handle shall be arranged in the natural circulation gas phase system, one shall be installed above free space of boiler and the other shall be installed on the heat user or air supply main above the system.

(2) Safety valve shall be arranged on flash tank and condensate drum of liquid-phase forced-circulation throttling pressure-reducing evaporation gas phase system, and two safety valves shall be arranged on flash tank with rated thermal power greater than 1.4MW.

(3) One bursting disc shall be cascaded on the short pipe connecting the safety valve of gas phase system and the boiler or pipeline; discharge capacity of the safety valve and the bursting disc shall be greater than or equal to the nominal capacity of the boiler. One stop valve shall be arranged on the short pipe connecting the bursting disc and the boiler or pipeline and it shall be open when the boiler is operating.

11.3.1.2 Liquid phase boiler and system

Safety valve shall be arranged between inlet and outlet block valves for liquid phase boiler. When liquid phase boiler is connected with expansion tank, and there is no valve on the pipeline between them, boiler proper may not be arranged with safety valve. Closed expansion tank shall be arranged with safety valve.

11.3.2 Safe decompression device

Safe decompression device shall be arranged for closed low storage tank.

11.3.3 Pressure measuring device

Pressure gauge shall be arranged on drum of gas phase boiler, outlet header, inlet and outlet pipings of liquid phase boiler, circulating pump, inlet and outlet of filter, pressure part as well as before and after control valve. Stop valve or needle valve shall be arranged above liquid deposit bending of pressure gauge.

11.3.4 Liquid level measuring device

(1) Components with liquid level such as drum, flash tank, condensate drum and expansion tank shall be arranged with one set of independent direct-reading liquid level meter and automatic liquid level detector respectively.

(2) Organic heat transfer material tank shall be arranged with one set of direct-reading liquid level meter;

(3) Direct-reading liquid level meter shall be a plate one, not glass tube one.

11.3.5 Temperature measuring device

Temperature measuring device of organic heat transfer material shall be arranged on inlet and outlet of boiler, flash tank of system, condensate drum, expansion tank and storage tank.

11.3.6 Safety protection device

11.3.6.1 Basic requirements

Safety protection devices of boiler and system shall be arranged according to their heating capacity, organic heat transfer material type, fuel type and operation condition, and shall be in accordance with the principle of guaranteeing safe operation.

When the total injection rate of gas phase organic heat transfer material in the boiler and the system is greater than 1m^3 and the that of the liquid phase organic heat transfer material is greater than 5m^3 , safety protection devices shall be arranged according to the requirements of Articles 11.3.6.2~11.3.6.6 in this Regulation.

11.3.6.2 Fire extinguishing system of furnace

Furnace of flame heating boiler shall be equipped with inert gas fire extinguishing system.

11.3.6.3 System alarm device

(1) Outlet of natural circulation gas phase boiler shall be arranged with overpressure alarm device;

(1) Outlet of liquid-phase forced circulation boiler shall be arranged with alarm devices of low flow, overheat, overpressure and low pressure for organic heat transfer material;

(2) Overheat alarm device of outlet flue gas shall be arranged for flame heating boiler;

(3) Flash tank, condensate drum and expansion tank shall be arranged with alarm devices of high and low liquid levels; and overpressure alarm device shall also be arranged for flash tank, condensate drum and closed expansion tank;

(4) Rapid discharge valve of expansion tank and rapid cut-off valve of expansion pipe shall be arranged with operated-alarm device.

11.3.6.4 Heating device interlock protection

Interlock protection device in the system shall be able to cut off the heating device and give off alarms.

(1) Liquid levels of evaporation container and condensate drum in the gas phase system and expansion tank in the liquid phase system drop to the set limit position;

(2) Outlet pressure of gas phase boiler exceeds the set limit;

(3) Outlet pressure of liquid phase boiler exceeds the set limit;

(4) For liquid phase boiler with quantity of parallel furnace tubes greater than or equal to 5, temperature at outlet of any furnace tube of organic heat transfer material exceeds the set limit;

(5) Flow for organic heat transfer material of the liquid-phase forced circulation boiler is lower than the set limit;

(6) Outlet gas temperature of flame heating boiler exceeds the set limit;

(7) Temperature at metal surface of electrical heating elements exceeds the set limit;

(8) Rapid discharge valve of expansion tank or rapid cut-off valve of expansion pipe operates;

(9) Overpressure alarm leading to operation of safety valve is found in the system;

(10) Interlocking of main device in the operating system shuts down.

11.3.6.5 System interlock protection

Interlock protection device in the organic heat transfer material system shall be able to disconnect the heating device and circulating pump, and give off alarms.

(1) Temperature of organic heat transfer material at boiler outlet and that of flue exceed the set limit at the same time;

(2) Low liquid level alarm of expansion tank and operated alarm for rapid cut-off valve of discharge valve or expansion pipe operate together;

(3) Total system shuts down emergency emergently.

11.3.6.6 Flow control valve of liquid phase system

Between supply main and return-flow main of the liquid-phase organic heat transfer material system, one automatic flow control valve or differential pressure relief valve shall be arranged.

11.4 Auxiliary equipment and system

11.4.1 Basic requirements

In design, manufacture, installation and operation of auxiliary equipment and system, overheat, oxidation, pollution and leak shall be avoided for organic heat transfer material in the system.

11.4.2 System design

Design type of the system shall be determined according to the characteristics and maximum working temperature as well as system operation mode of the selected organic heat transfer material. In case of one of the following conditions, closed cycle system shall be designed:

(1) System with gas-phase organic heat transfer material;

(2) System with organic heat transfer material belonging to dangerous chemicals;

(3) System in which the maximum working temperature is higher than the initial boiling point of the selected organic heat transfer material under ordinary pressure, or vapor pressure of the organic heat transfer material under maximum working temperature is higher than 0.01MPa;

(4) System with quantity of one-off injected organic heat transfer material larger than 10m³;

- (5) System with frequently changed heat load and working temperature .

11.4.3 Material

Materials of pressure part, piping and its accessories in the system shall meet the requirements of the maximum working temperature, moreover, they shall not be manufactured with cast iron or non-ferrous metal.

11.4.4 Pipe fitting and valve

(1) Nominal pressure of pipe fitting and valve in the liquid phase system shall be greater than or equal to 1.6MPa, and greater than or equal to 2.5MPa in the gas phase system; stop valve and control valve sealed with sylphon bellows shall be used in the system;

(2) Piping, valve and pipe fitting in the system shall be connected by welding generally, welding of piping shall be carried out with gas-shielded arc welding as base coat. Where flange connection is adopted, raised-face male and female flange or tongue and groove flange shall be selected, and its gasket shall be metal-mesh strengthened graphite gasket or metal-winded graphite composite gasket; threaded connection should not be used in the system except for instrument and apparatus.

11.4.5 Circulating pump

11.4.5.1 Selection of circulating pump

(1) For liquid phase heat transfer system and liquid-phase forced-circulation throttling pressure-reducing evaporation gas phase system, at least two motor-driven circulating pumps and condensate supply pumps shall be installed, when one of them stops operation, total flow of the rest circulating pump or supply pump shall be able to meet the operation requirements of the system under maximum capability;

(2) In selection of flow and lift for circulating pump, the minimum flow passing the organic heat transfer material of boiler is greater than or equal to the allowable minimum flow of boiler shall be guaranteed;

(3) For system with the maximum working temperature of organic heat transfer material below its initial boiling point under ordinary pressure, pump with extended cooling section may be adopted.

(4) For system with the maximum working temperature above its initial boiling point under ordinary pressure, bearing or shaft seal of the pump shall be provided with independent cooling device, and moreover, an alarm device shall be set. When cooling system of circulating pump fails, the alarm device is able to work;

(5) For system with gas-phase organic heat transfer material, pumps without shaft seal such as shield pump and electromagnetic coupling pump shall be adopted.

11.4.5.2 Power supply of circulating pump

In order to prevent excessive temperature rise of organic heat transfer material in boiler after shut down of circulating pump due to suddenly power off, two-circuit power supply shall be adopted for furnace body of boiler with relatively large heat storage, and moreover, standby power supply shall be provided with or other measures shall be adopted.

11.4.5.3 Filter

Filter with dismountable strainers shall be arranged at inlet of circulating pump. One by-pass fine filter shall be arranged in the liquid-phase heat transfer system.

11.4.6 Exhaust of gas phase system

Exhaust when safety valve of gas phase system is on and that of vacuum device shall be carried out after the gas is fluidized under reduced temperature, and the gas shall be exhausted into separate

organic heat transfer material collecting tank. The collected organic heat transfer material shall not be reused before treatment.

11.4.7 Expansion tank in liquid phase system

Expansion tank shall be set for liquid phase system, and its design shall meet the following requirements:

(1) When no effective isolation measure is adopted between expansion tank and boiler, it shall not be set right above the boiler;

(2) Constant-pressure device shall be provided for closed expansion tank protected by inert gas. If the maximum pressure of gas in the closed expansion tank is less than 0.01MPa, liquid-sealing may be adopted for restricting overpressure. Vent pipe shall be provided for open expansion tank, and its size shall be in accordance with those specified in Table 11-1.

(3) The regulating volume of expansion tank shall be greater than or equal to 1.3 times of the expanded volume due to the rise of organic heat transfer material in the system from ambient temperature to the maximum working temperature;

(4) When the expansion of the organic heat transfer material in the whole system is held by the high expansion tank and low container jointly, the high expansion tank shall be arranged with liquid level automatic control device and overflow pipe, and the overflow pipe shall not be arranged with valve and size of the pipe shall be in accordance with the requirements of Table 11-1;

(5) For expansion pipes connected with expansion tank, at least one of them shall not be arranged with valve, and the pipe diameter shall be greater than or equal to those specified in Table 11-1;

(6) For expansion tank with volume larger than or equal to 20m³, an independent rapid discharge valve shall be set, or expansion pipeline shall be set respectively for its internal gas phase and liquid phase spaces; and moreover a rapid cut-off valve shall be set on liquid phase expansion pipeline.

Table 11-1 Size for Expansion Pipe, Overflow Pipe, Discharge Pipe and Vent Pipe of Expansion Tank

Installed total power of boiler in the system (MW), ≤	0.025	0.1	0.6	0.9	1.2	2.4	6.0	12	24	35
Nominal size of expansion and overflow pipes DN (mm)	15	20	25	32	40	50	65	80	100	150
Nominal size of discharge and vent pipes DN (mm)	20	25	32	40	50	65	80	100	150	200

11.4.8 Storage tank for organic heat transfer material

Storage tank shall be provided for system with organic heat transfer material volume exceeding 1m³, for the discharge of organic heat transfer material in the system. Volume of the storage tank shall be able to hold the organic heat transfer material in the maximum isolated part, and the proper additional reserve needed by the system.

11.4.9 Sampling cooler

The system shall be arranged with at least one sampling cooler for the organic heat transfer material. The sampling cooler in the liquid phase system shall be installed between the inlet and outlet of the circulating pump or supply main and return-flow main of the organic heat transfer material. Sampling cooler in the gas phase system shall be installed between the inlet and outlet of the boiler circulating pump.

11.4.10 Static protection

Static protection measures shall be taken for equipment and pipeline in the organic heat transfer material system.

11.5 Service management

11.5.1 Degasification and dehydration of organic heat transfer material

(1) During cold start of boiler, degasification and dehydration shall be carried out for the organic heat transfer material when temperature of the medium in the expansion tank reaches 110~120℃ in the process of circulating temperature rise in the system.

(2) Proper measures shall be taken to carry out degasification, and moreover its condensate shall be safely collected when low-boiling organic heat transfer material in the system accumulates to above 5%.

11.5.2 Supplement of organic heat transfer material in the system

The cold organic heat transfer material shall be injected into the expansion tank at first and then into the main circulation loop of the system indirectly through the expansion tank when organic heat transfer material supplementation is required by the system during normal operation of the boiler.

11.5.3 Maintenance and repair of boiler and system

(1) During inspection and repair of the system, component in the circulation system shall be welded after the mixture of flammable gas and air are removed by inert gas; and in the whole welding process, the removing operation shall be carried out continuously;

(2) Insulation material in the system soaked by organic heat transfer material shall not be used any longer; the burned insulating layer shall not be opened immediately, and it must be removed and changed after it is cooled.

12 Cast-iron Boiler

12.1 Allowable application scope

- (1) Steam boiler with rated working pressure less than 0.1MPa;
- (2) Hot-water boiler with nominal outlet temperature less than 120℃ and rated working pressure not exceed 0.7MPa.

12.2 Material

- (1) Cast-iron boiler shall be made of grey cast iron with designation greater than or equal to HT 150 regulated in "Grey Iron Castings" (GB 9439);
- (2) Pressure cast shall not have such casting defects as cracks, penetrative gas hole, shrinkage cavity, shrinkage porosity, inadequate pouring and cold shut;
- (3) Steel pressure element, fastening tie rod in a cast-iron boiler shall be in accordance with the relevant rules of other chapters in this Regulation.

12.3 Design

12.3.1 Basic requirements

- (1) Rated working pressure of cast iron hot-water boiler shall be greater than or equal to the saturation pressure corresponding to the nominal outlet temperature plus 40 ℃.
- (2) The boiler shall be of assemble type, and joints between boiler sections shall be sealed reliably; the minimum thickness of the boiler section is generally greater than or equal to 5mm, and diameter of the fastening tie rod between boiler sections is generally greater than or equal to 10mm;
- (3) Locations at boiler bottom where sediment incrustation is easy to form shall be set cleaning holes with inner diameter greater than or equal to 25mm.

12.3.2 Cold burst proof test

12.3.2.1 Conditions of proof test implementation

In case of one of the following conditions, cold burst proof test shall be carried out for boiler sections or boilers, and moreover, it shall be verified on-site by appraisal institute of design document with corresponding qualification.

- (1) New boiler section structure is adopted;
- (2) Material designation of the boiler section is changed;
- (3) More than 5 years after it has been qualified in the previous cold burst proof test.

12.3.2.2 Quantity of boiler sections in burst test

3 boiler sections of the same kind, which are respectively of the front part, middle part and the rear part, shall be taken for the burst test.

12.3.2.3 Burst test pressure

- (1) For steam boiler, it shall be greater than or equal to 1.4MPa;
- (2) For hot-water boiler, when its rated water outlet pressure is less than or equal to 0.4MPa, the burst pressure shall be greater than $4P+0.2\text{MPa}$; otherwise the burst pressure shall be greater than $5.25P$.

12.3.3 Hydraulic test for overall confirmation

For newly-designed cast-iron boiler, hydraulic test shall be carried out for its overall confirmation, and moreover, the test shall be verified on-site by qualified design document appraisal institute. The pressure holding time and acceptance criteria shall meet the relevant regulations of Chapter 4 in this Regulation.

The hydraulic test pressure for overall confirmation shall meet the following requirements:

- (1) Test pressure of steam boiler is 1.2MPa;
- (2) Test pressure of hot-water boiler is $2P$ and greater than or equal to 0.6MPa.

12.4 Manufacture

12.4.1 Casting process

The manufacturer shall draft the casting process regulation for pressure casting being verified, and moreover, produce castings according to it.

12.4.2 Mechanical property inspection for pressure casting

(1) Tensile specimen for pressure casting shall be made out of each hot metal ladle or each piece of boiler section. The specimen shall be poured according to "Grey Iron Castings" (GB 9439). Each hot metal ladle or each piece of boiler section shall be provided with 3 specimens with 1 for the inspection and the rest for reinspection.

(2) Tensile test shall be carried out according to "Methods for Testing the Mechanical Properties of Grey Cast Iron" (JB/T 7945), and if tensile strength of the specimen is greater than or equal to the specified lower limit of tensile strength for designation of cast iron used, it will be judged as qualified; and if the first specimen is rejected, then other 2 specimens will be taken for reinspection, and if they are both judged as qualified, the tensile test of the pressure casting will be regarded as qualified, and otherwise it will be regarded as unqualified, and then the boiler section represented by the specimen is rejected.

(3) For pressure casting continuously poured in the same furnace, if the hot metal ladles or boiler sections poured at first and at last are qualified in tensile test, tensile test may not be carried out for the other pressure casting; otherwise other ladles or sections shall have tension tests..

12.4.3 Thickness control of boiler section

The manufacturer shall take effective method to control the minimum wall thickness. For boiler sections manufactured in the same batch (with the same designation, structure and casting process), more than or equal to 20% of which shall be subject to thickness measurement. The number of boiler section shall be more than one. The boiler section shall be equipped with measuring point figure, and measurement for thickness shall be carried out for at least 5 positions on each side.

12.4.4 Hydraulic test

Hydraulic test shall be carried out for rough boiler sections, machined boiler sections, repaired boiler sections and other pressure castings one by one. It shall be carried out for assembled boilers as a whole, and the test pressure and pressure holding time shall be in accordance with the rules of Table 12-1, method and acceptance criteria of the test shall conform to the rules of Chapter 4 in this Regulation.

Table 12-1 Test Pressure and Pressure Holding Time

Name		Hydraulic test pressure (MPa)	Pressure holding time under test pressure (min)
Pressure casting	Steam boiler	≥ 1.0	2
	Hot-water boiler	$2p, \geq 0.4$	2
Boiler integrity	Steam boiler	≥ 0.4	20
	Hot-water boiler	$1.5p, \geq 0.4$	20

12.4.5 Repair of pressure casting

The method of repair welding shall not be adopted for defects on radiant heating surface of pressure casting and in stress concentration area. If the pressure casting have such defects as crack, shrinkage porosity or disperse sand inclusion (slag), repair welding shall not be carried out either.

12.5 Service

Hydraulic test in periodical inspection shall be carried out according to the test requirements in manufacturing process.

13 Level D Boiler

13.1 Basic requirements

(1) Pressure parts of multifunctional boiler (steam and hot water) and hot-water boiler may be made of aluminum, copper alloy and stainless steel. Welded pipe with material in accordance with the relevant standard may be adopted as its pipe, and other boiler material shall be in accordance with the rules of this Regulation;

(2) Drum (shell), boiler furnace and the connected head and tube sheet of multifunctional boiler (steam and hot water) and hot-water boiler may be adopted with a structure of plug-in full-penetration T connection.

(3) Water capacity of boiler in design of normal water level shall be indicated on the design drawing of steam boiler;

(4) Where the calculated strength is met, the adopted wall thicknesses of drum (shell), boiler furnace (top) and tube sheet (head) shall be greater than or equal to 3mm. The adopted Wall thickness of boiler drum (shell) or furnace of aluminum boiler shall be greater than or equal to 4mm, and the weld efficiency of steam boiler Φ shall take 0.8;

(5) Boiler must not be altered;

(6) For organic heat transfer material boiler with rated thermal power less than 0.01MW, it may only meet the requirements of manufacturing license, and its technical requirements shall be in accordance with the corresponding standards.

13.2 Manufacture

(1) Product welded coupons may not be made during manufacturing process of boiler;

(2) For hot-water boiler and steam boiler with rated working pressure less than or equal to 0.1MPa, non-destructive testing may not be carried out where weld quality is guaranteed by the boiler manufacturer;

(3) The boiler manufacturer shall mark safety caution on conspicuous position of the boiler, and caution of multifunctional boiler (steam and hot water) shall at least cover items such as “no overpressure operation”, “water shortage” and “water seal device must not be installed with valve”;

(4) Nameplate of steam boiler shall indicate its service life which shall be less than or equal to 8 years.

13.3 Safety accessories and instruments

13.3.1 Requirements of safety accessories and instruments for steam boiler

(1) Boiler proper shall be installed with at least one spring safety valve, its discharge capacity shall be calculated according to the requirements of Chapter 6 in this Regulation, and moreover, its flow channel diameter shall be greater than or equal to 10mm;

- (2) Boiler shall be installed with at least one pressure gauge and water level gauge;
- (3) Boiler shall be installed with reliable overpressure alarm, low water level alarm or interlock protection device and be regularly maintained.

13.3.2 Requirements of safety accessories and instruments for multifunctional boiler (steam and hot water)

- (1) Boiler shall be installed with safety valve or water-sealed safety device in accordance with the requirements of Article 13.3.3 in this Regulation;
- (2) Boiler shall be installed with at least one pressure gauge and water level gauge;
- (3) Boiler shall be installed with reliable overpressure alarm, low water level alarm or interlock protection device and be regularly maintained.

13.3.3 Requirements of multifunctional boiler (steam and hot water) water-sealed safety device

- (1) Diameter of sealing water pipe shall be determined according to the nominal capacity and pressure, and moreover, its inner diameter shall be greater than or equal to 25mm;
- (2) During installation of water seal device, lower end of the sealing water pipe shall be 50mm higher than the highest fire line, and the effective water column height shall not exceed 4m;
- (3) Sealing water pipe shall not be installed with valve, and meanwhile, anti-freezing measures shall be provided.

13.3.4 Connection between blowdown pipe and blowdown valve

Threaded connection may be adopted for boiler blowdown pipe and blowdown valve except organic heat transfer material boiler.

13.4 Installation

- (1) It's not necessary to build independent boiler house for steam boiler, hot-water boiler and organic heat transfer material boiler; and installation position of steam boiler shall be effectively isolated with the non-operation personnel;
- (2) Notice is not required to be installed for steam boiler, hot-water boiler and organic heat transfer material boiler, and moreover, installation supervisory inspection are not performed;
- (3) After the boiler is installed, its manufacturer or authorized installation unit shall train the operation personnel in aspects of operation, safety management and emergency treatment. The operation personnel will be provided with written certificate after qualified in the training;
- (4) The boiler may be operated only after both representatives of the boiler manufacturer or the authorized installation unit and boiler user approved with written acceptance .

13.5 Periodical inspection

Periodical inspection shall be carried out for multifunctional boiler (steam and hot water) according to the requirements of Article 9.4 in this Regulation.

13.6 Service

(1) Service registration shall be carried out for multifunctional boiler (steam and hot water) as required, while it is not necessary for other boilers.

(2) Boiler users shall operate boiler in strict accordance with application instruction of the boiler, and periodical maintenance and inspection shall be performed to ensure the safety accessories and instruments are sensitive and reliable;

(3) In case of malfunction or abnormal conditions of boiler, the user shall carry out overall inspection for the boiler, and only after the accident potential is eliminated, the boiler may be put into service over again;

(4) It is not necessary for operation personnel of steam boiler, hot-water boiler and organic heat transfer material boiler to obtain "Special Equipment Operator Certificate", however they shall be trained according to the rules of item (3) in Article 13.4 of this Regulation.

14 Supplementary Provisions

14.1 Interpretation authorization

The General Administration of Quality Supervision, Inspection and Quarantine has the authority to provide official interpretation of this Regulation.

14.2 Implementation time

This Regulation is implemented from June 1, 2013. "Steam Boiler Safety Technology Supervisory Regulations" issued by the former Department of Labor on August 19, 1996 (Document LAOBUFA [1996] No. 276), "Boiler Safety Technical Supervision Administration Regulation" issued on May 20, 1991 (Document LAOGUOZI [1991] No. 8) and "Notice on Printing Relevant Chapters and Sections of Revised 'Boiler Safety Technical Supervision Administration Regulation'" issued on February 14, 1997 (Document LAOGUOZI [1997] No. 74) and "Technical Supervision Regulation for Safety of Organic Thermal Substrate Boilers" (Document LAOBUFA [1993] No. 356) are abolished simultaneously.

Annex A Product Conformity Certificate of Boilers

Serial No:

Manufacturer			
Organization Code		Manufacture License No.	
Manufacture Licensing Level		Product Name	
Product Model		Product No.	
Equipment Code		Equipment Level	
Manufacture Date:			
<p>This product has passed the inspection during manufacturing and is in accordance with the “Boiler Safety Technical Supervision Administration Regulation”, and the requirements of design drawing, relevant technical standards and order contract.</p> <p>Responsible Inspection Engineer(Signature/Stamp): Date:</p> <p>Quality Assurance Engineer(Signature/Stamp): Date:</p> <p>Seal for product quality inspection Date:</p>			

Note: This quality conformity certificate covers the accompanied product data sheet of boilers, the manufacturer shall input the information into the special equipment database according to the requirements of special equipment informationization..

Attached Table A Product Data Sheet of Boilers

Serial No:

Equipment Category	(Steam boiler, hot water boiler , organic heat transfer material boiler and boiler component)			Product Name				
Product Model				Product Serial No				
Equipment Code				Equipment Level				
Design Conditions	Date of Design Documents Appraisal			Serial Number of Appraisal Report				
	Name of Appraisal Agency							
Main Parameters	Rated Evaporating Capacity (Thermal power)	t/h(MW)		Rated Working pressure		MPa		
	Rated Working Temperature	℃		Design Thermal Efficiency		%		
	Feed Water Temperature	℃		Rated Outlet/Back Water (Oil) Temperature		/ ℃		
	Boiler Proper Water (Oil) Capacity	L		Medium/Pressure of Integrative Boiler Proper in Hydraulic Test		/ MPa		
	Re-heater Inlet (Outlet) Temperature	/ ℃		Re-heater Inlet (Outlet) Pressure		/ MPa		
	Reheated Steam Flow	t/h		Medium/Pressure of Organic Heat Transfer Material Boiler in Gas-tightness Test		/ MPa		
	Combustion Mode	(layer burning, chamber combustion, fluidized bed and others)		Fuel (Heat Source) Types		(Oil, Gas , Coal, Coal Water Slurry, Wood, Biomass, Electricity, Residual Heat and Others)		
Main Pressure Parts	Material	Wall Thickness (mm)	NDT		Heat Treatment		Hydrostatic(Pressure) Test	
			Method	Proportion (%)	Temperature (℃)	Time (h)	Medium	Pressure (Mpa)

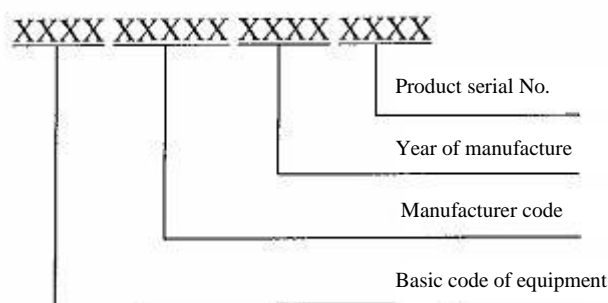
Data of Safety Valve							
Model		Specification		Quantity		Manufacturer	
Manufacturing Supervisory Inspection	Supervisory Inspection Institute						
	Organization Code				Approved Certificate Number		

Note: The specific item of this Table can be compiled according to boiler categories, only drum (shell), super-heater outlet header, starting-up separator main need to be filled out for main pressure parts. Other related data shall be provided as the other requirements for product delivery documents.

Annex B Numbering Method of Special Equipment Code

B1 Basic method of numbering

The equipment code is the identification of equipment, it must be with uniqueness and consists of the basic code of the equipment, manufacturer code, year of manufacture and product serial No., between which there are no spaces.



B2 Meaning of the code

B2.1 Equipment basic code

It is compiled according to the equipment code of type (four Arabic numerals) in "List of Special Equipments" e.g. pressure-bearing steam boiler is "1100", pressure-bearing hot-water boiler is "1200" and organic heat transfer material boiler is "1300".

B2.2 Code of manufacturer

It is consisted of the administrative area code (2 Arabic numerals) of the location of manufacturing license approving authority and the manufacturer serial number (3 Arabic numerals) in manufacturing license of the manufacturer. e.g. For a boiler manufacturer located in Heilongjiang Province, if it is reviewed and approved by AQSIQ, and its manufacturing license No. is "TS 2110890-2012", 10 will represent the AQSIQ administrative area code, and where the serial No. of the license is 890, and the manufacturer code will be "10890"; if it is reviewed and approved by Quality & Technical Supervision Bureau of Heilongjiang Province, its manufacturing license No. will be "TS 2123010-2012", and 23 will represent the administrative area code, where the serial No. of the license is 10, the manufacturer code will be "23010".

B2.3 Manufacture year

The year when the product is manufactured (4 Arabic numerals); e.g. If it is manufactured in 2012, the manufacture year will be "2012".

B2.4 Product serial No.

The product serial number is numbered by the manufacturer itself (4 Arabic numerals). e.g. If the manufacture serial No. of a certain variety boiler manufactured in 2012 is 89, it will be numbered as "0089".

If the product serial No. is greater than 9999, the No. may be replaced by phonetic alphabets. e.g. If the manufacture serial No. of a certain variety boiler is 10000 or 11000, the manufacture sequence No. will be A 000 or B 000, the rest may be deduced by analogy.

Development (Revision) of Relevant Regulations and Specifications

[1] Steam Boiler Safety Technology Supervisory Regulations [Department of Labor (60) LAOHUMAOZI No. 102; it was issued on October 22, 1960 and came into effect from this day off.]

[2] Steam Boiler Safety Technology Supervisory Regulations [Department of Labor (65) LAOGUOZI No. 98; it was issued on October 12, 1965 and came into effect from this day off.]

[3] Steam Boiler Safety Technology Supervisory Regulations [State Labour Bureau (80) LAOZONGGUOZI No. 23; it was issued on July 11, 1980, implemented on January 1, 1981 and abolished on October 1, 1987];

[4] Boiler Safety Technical Supervision Administration Regulation (Ministry of Labour and Personnel LAORENGUO [1983] No. 4; it was issued on June 3, 1983 and came into effect on July 1, 1984);

[3] Steam Boiler Safety Technology Supervisory Regulations (Ministry of Labour and Personnel LAORENGUO [1987] No. 4; it was issued on February 17, 1987, implemented on October 1, 1987 and abolished on January 1, 1997);

[6] Boiler Safety Technical Supervision Administration Regulation (Department of Labor LAOGUOZI [1991] No. 8; it was issued on May 22, 1991 and implemented on January 1, 1992);

[7] Technical Supervision Regulation for Safety of Organic Thermal Substrate Boilers (Department of Labor LAOBUFA [1993] No. 356; it was Printed and Published on November 28, 1993 and implemented on May 1, 1994);

[8] Steam Boiler Safety Technology Supervisory Regulations (Department of Labor LAOBUFA [1996] NO. 276; it was issued on August 19, 1996 and implemented on January 1, 1997);

[9] Boiler Safety Technical Supervision Administration Regulation (Department of Labor LAOBUFA [1997] No. 74; it was Printed and Published on February 14, 1997 and is a revision of relevant chapters and sections in Edition 1992);

[10] Regulation for Safety Technical Supervision of Small Steam Boiler and Atmosphere Hot-Water Boiler (State Bureau of Quality and Technical Supervision, Decree No. 2000, No. 11)