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WCB ULTRA-LOW NO_x STEAM BOILER

Rated Capacity: **2 – 40t/h**

Rated Steam Pressure: **1.25 – 2.5MPa**

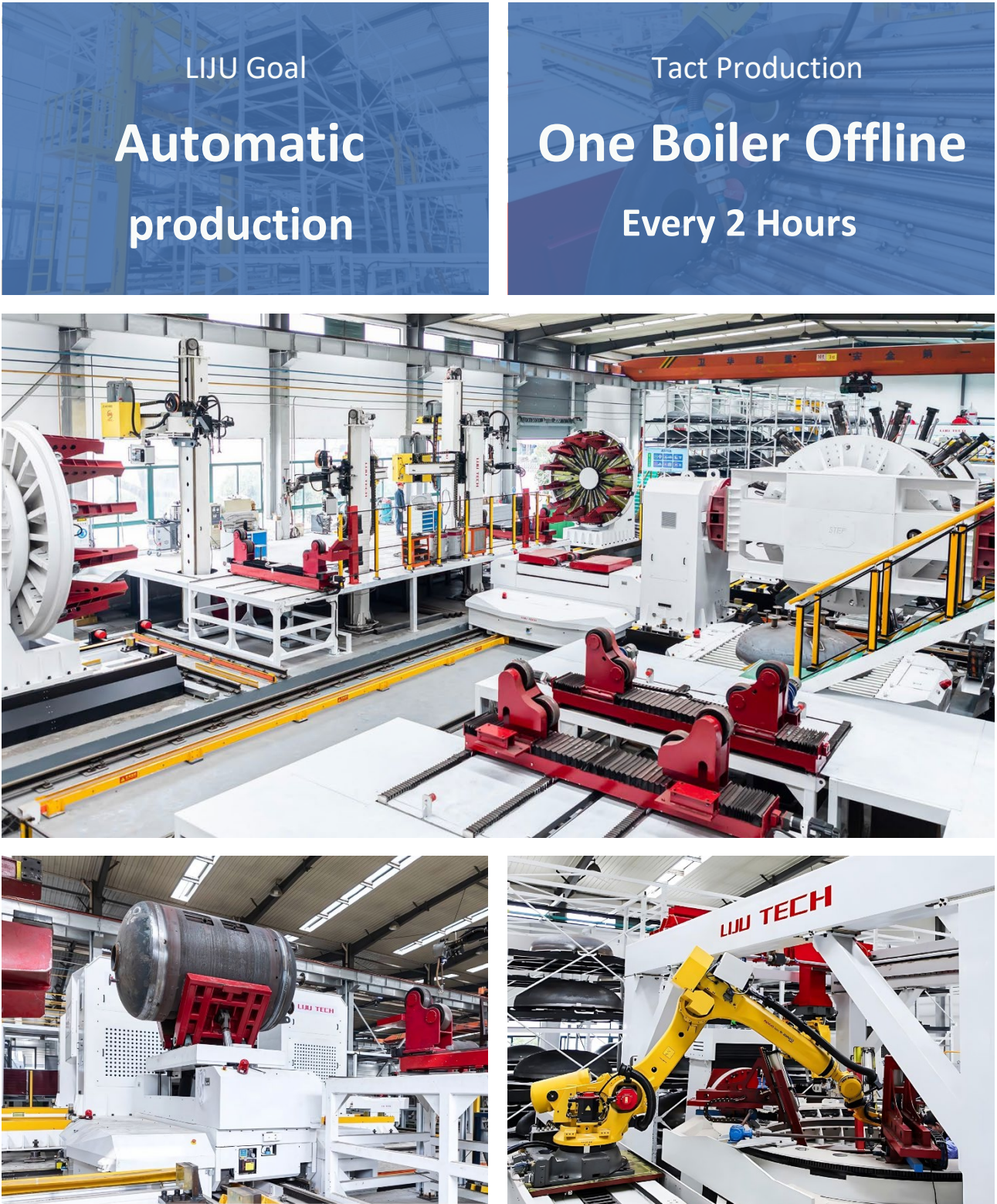
Suitable Fuel: **Natural gas/LPG etc.**



Typical user



Proprietary manufacturing RW/RGV-aided production line

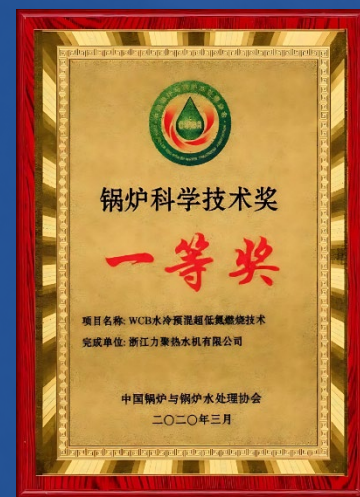


Core Technologies

Water-cooling Premixed

Ultra-Low NO_x Combustion Technology

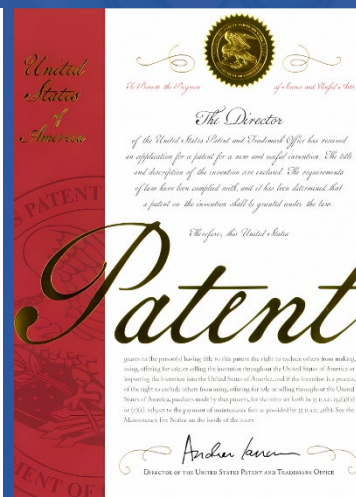
Theoretically, gas combustion is generally classified into diffusion combustion and premixed combustion. And the latter has better combustion efficiency and lower emission. Conventional boilers implement diffusion combustion, and through the FGR flue gas recirculation to achieve ultra-low NO_x emission down to 50mg/m³. Pre-mixed combustion has been widely applied in small capacity boilers (such as gas stoves, wall-hanging stoves, etc.) for decades due to certain safety risks, hence seldom in large industrial boilers. Since 2005, on top of being a boiler manufacturer, LIJU has been independently developing gas combustion technology, and invented a unique gas combustion technology – WCB water-cooling premixed combustion technology, and successfully applied this technology to gas hot water boilers and steam boilers. This technology fundamentally resolves the safety risk of large capacity premixed combustion, the balance of high efficiency combustion and ultra-low NO_x emission, and meets the most stringent environmental emission standards. LIJU owns complete independent intellectual property rights of WCB water-cooling premixed combustion technology, awarded the first prize of “National Boiler Science and Technology Award” in China, patented in China and the U.S. The maximum output of one WCB burner reaches 35MW.



First Prize of Boiler Science and Technology Award



Chinese Invention Patent

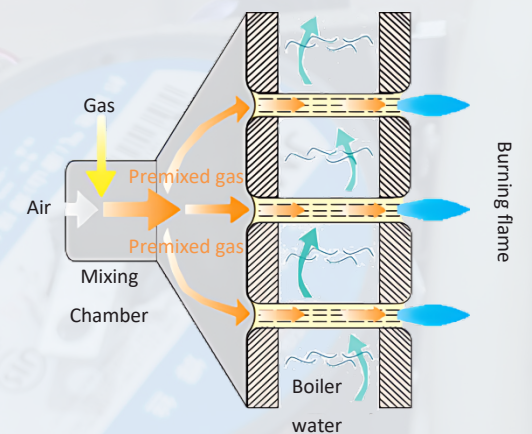


US Invention Patent

Principle of WCB

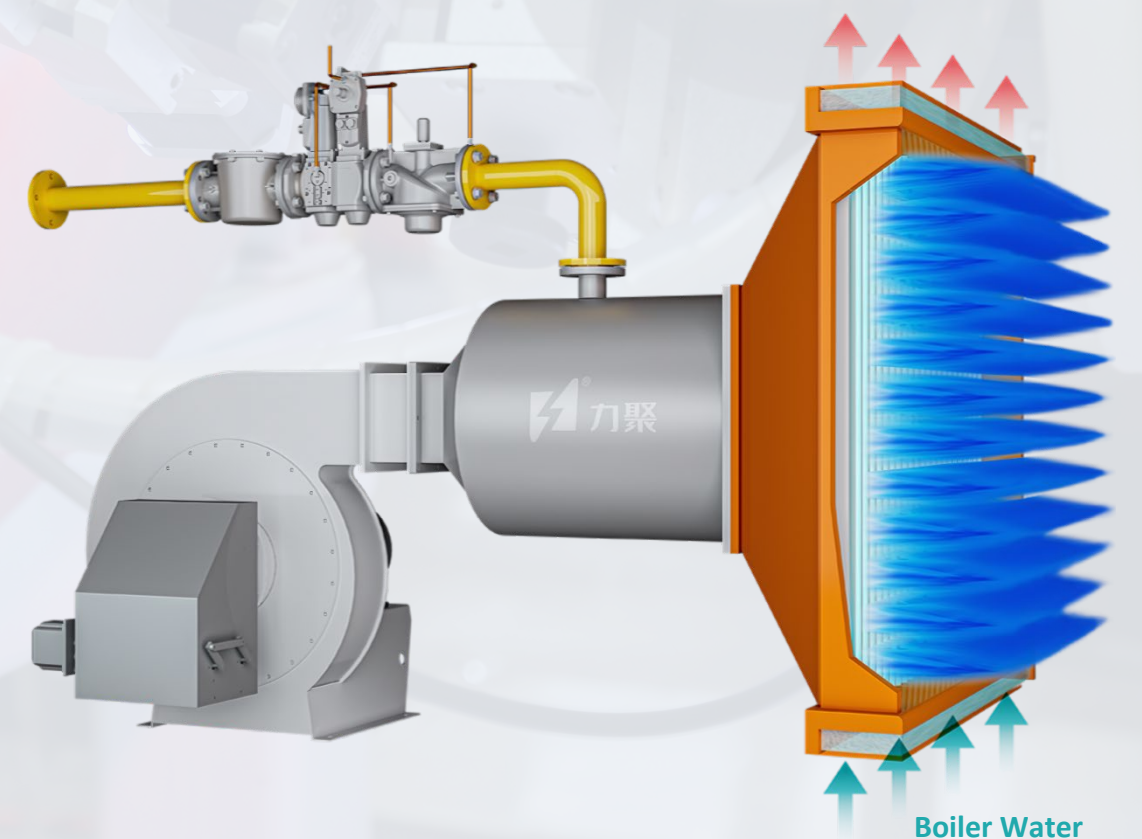
Water-cooling Premixed Combustion Technology

Water-cooling premixed combustion is a type of premixed combustion. Natural gas and air are pre-mixed proportionally, and the premixed gas passed through a water cooling tube screen and ignited. As the gas and air are premixed, the combustion reaction is gas and the flame is pure blue in color and short in length. The water-cooling tube screen effectively absorbs the heat of combustion and lowers the flame temperature, resulting in ultra-low NO_x emissions (NO_x<30mg/m³).



WCB Water-cooling Premixed Combustion Technology

NO_x<30mg/m³, without FGR

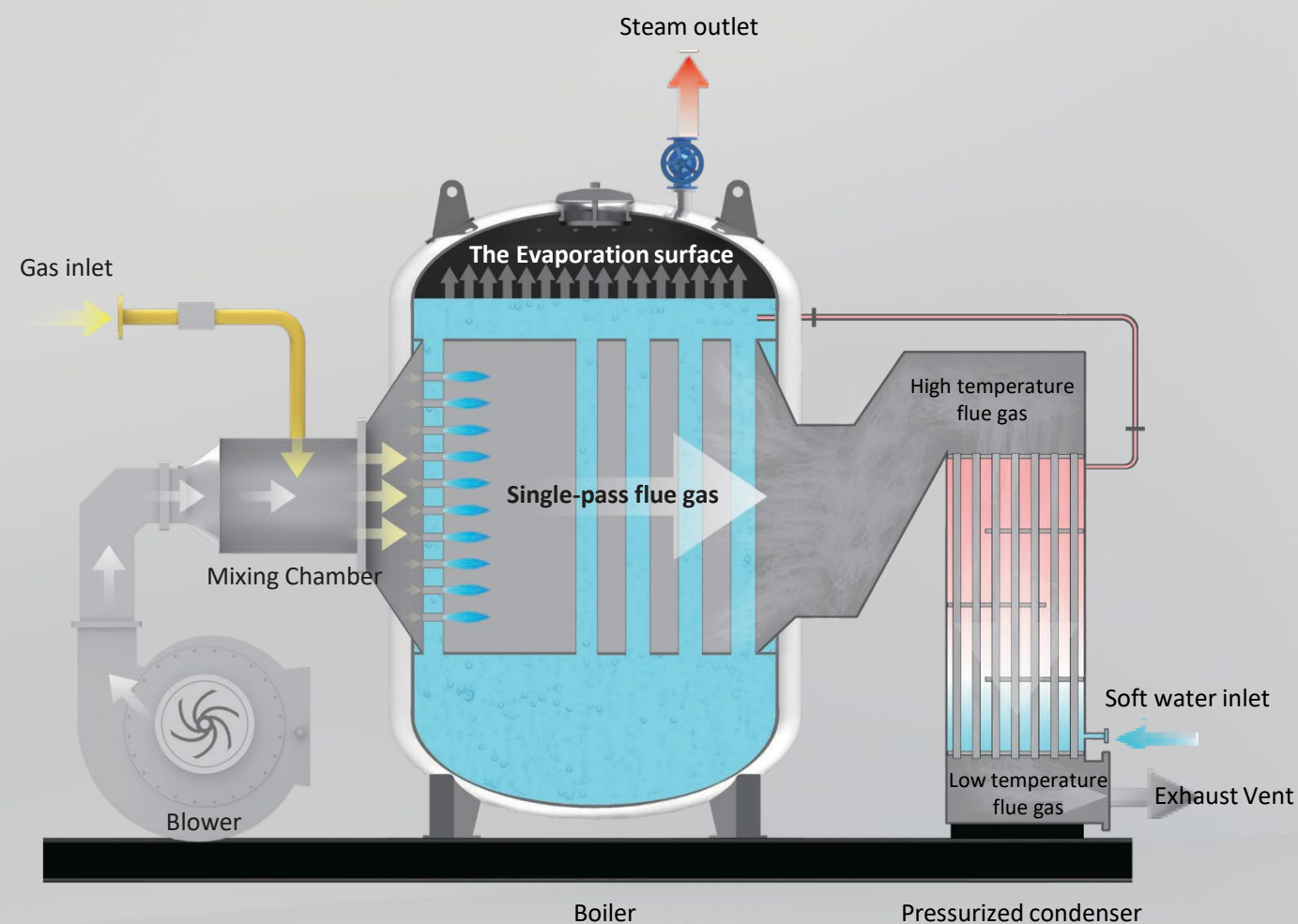


WCB Water-cooling Premixed Steam Boiler

Break away from convention

Create a new type of steam boiler

LIJU creatively integrates WCB ultra-low NO_x technology with steam boiler and develops a unique structure of the WCB steam boiler, which combines the durability of a fire-tube boiler with the dexterity of a water-tube boiler, with a higher boiler operating efficiency and lower NO_x emissions, and raise the bar of boiler safety, energy-saving and environmentally friendly!



Super efficient condensing steam boiler

< 30 mg/m³
NO_x Emissions

(Note: FGR flue gas recirculation is not required)

< 58 °C^{Note 1}
Exhaust Temperature

(Note: Steam boiler theoretical minimum exhaust temperature is 47)^{Note 2}

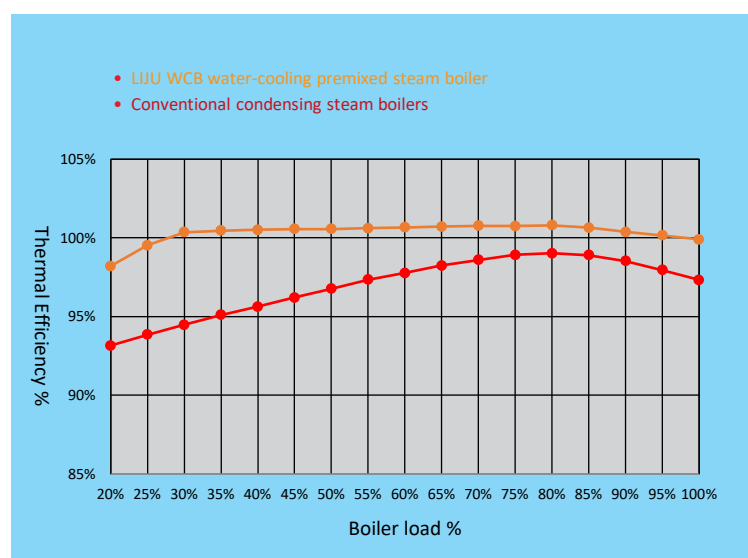
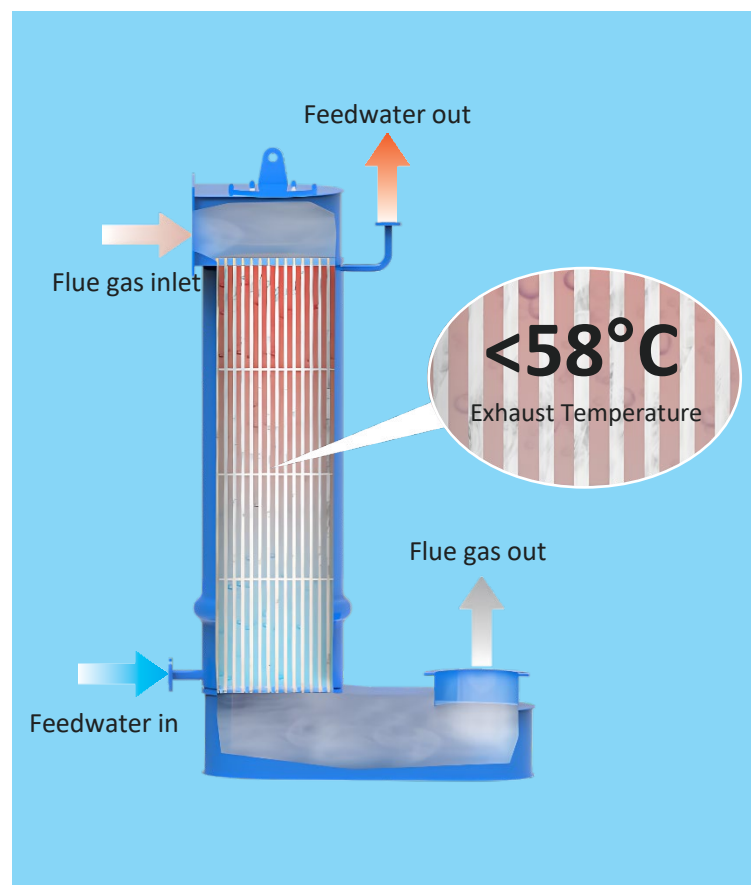


Note 1: 20°C water supply condition, no air preheating

Note 2: Feed water at 20°C, ambient temperature at 20°C, without air preheating

WCB Water-Cooling Premixed Steam Boiler

Features



Note 1: 20°C feed water condition, no air preheating; Note 2: 20°C feed water condition, no air preheating, calculated according to the low heating value.

01

Rated Exhaust Temperature <58°C Note 1

Thermal efficiency up to 99% or more Note 2

Countercurrent "microchannel" flue gas condenser

Sufficient heat exchange of flue gas, good condensation effect

The flue gas condenser adopts costly SUS316L stainless steel tubes instead of conventional ND carbon steel finned tubes, and adopts vertical structure, where the high-temperature flue gas travels from the top to the bottom, and the low-temperature cold water flows from the bottom to the top, forming a countercurrent heat exchange, which reduces the temperature of the boiler exhaust flue gas to below 58°C. SUS316L stainless steel tube can effectively prevent the corrosion of flue gas condensate and prolong the service life.

02

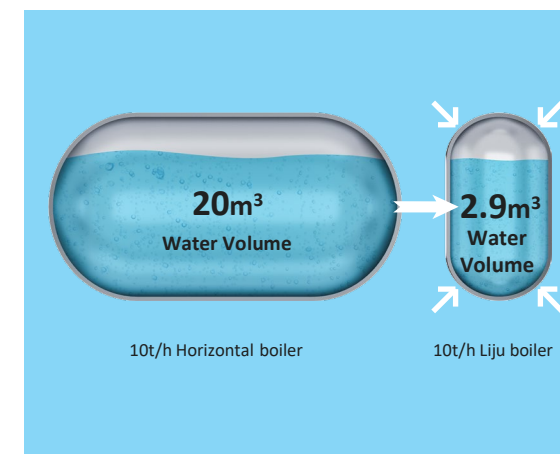
Efficient operation at full load
Solve the phenomenon of "big horse pulling small cart"

High efficiency operating range: 30%-100% (10%-100% for special models)

Full pre-mixed combustion is characterized by low load can also achieve high efficiency combustion, LIJU boiler using VFD technology with wide combustion adjustment range. Small loads can also be run efficiently, a complete solution to the conventional boiler, especially suitable for steam load fluctuations application.

Boiler operation

Safer, More energy saving, More ECO friendly



03

Fast startup, 5-8 minutes

Vertical water-tube design, small size, small water content, fast startup

LIJU boiler adopts vertical water tube structure, and with the upper and lower two drums combined into a capsule-shaped pressure vessel. The water content is only 1/6 of the traditional horizontal fire-tube boiler, the startup time is only 5-8 minutes.



04

Automatic controlled blowdown at ambient temp. by efficient heat recovery

TDS, high temperature conductivity detector and automatic blowdown heat recovery system

Each boiler is equipped with TDS conductivity detector, and blows down concentrated surface boiler water, and its heat is transferred to the feeding water via a blowdown heat recovery system.



05

Dual VFD control, higher adjustment precision, more electricity saving

Standard burner inverter and feed pump inverter, CFD combustion, CFD water supply

Each boiler is equipped with burner frequency inverter and feed water pump frequency inverter, automatically adjusting the combustion and feeding water responding to the steam load. Electricity consumption per ton of steam can be saved by more than 30%.

Performance Parameters

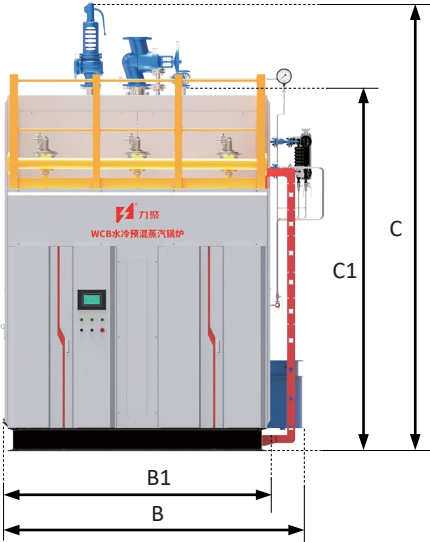
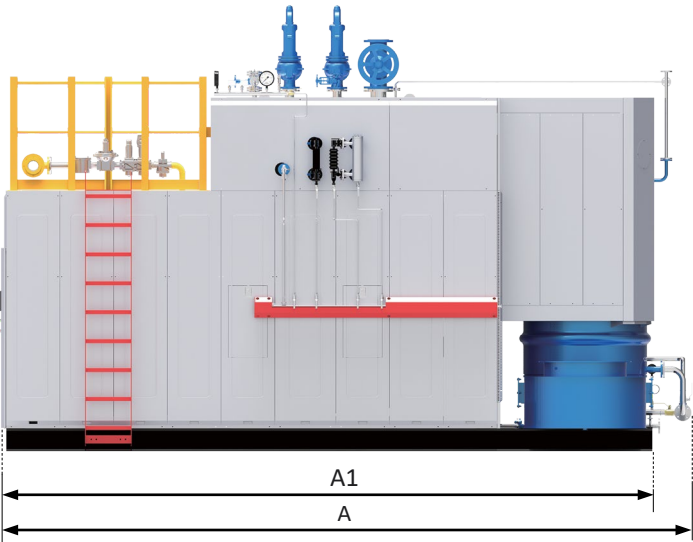
Model		LSS	2	3	4	5	6	8	10	12	15	20	40	
Rated Output		t/h	2	3	4	5	6	8	10	12	15	20	40	
Rated Steam Pressure		MPa 1.25 (1.6)												
Rated Steam Temperature		°C 193 (204)												
Electricity		V/Hz 380/50												
Electric power	Distribution Power	kW	9.7	15.0	19.0	20.5 (22.5)	24.0 (26.0)	41.0	41.0	48.0	70.0	93.5 (97.0)	187.0 (194.0)	
	Maximum usage of electric power	kW	6.9	11.0	13.4	17.2 (19.0)	19.7 (21.5)	33.3	34.4	41.7	56.0	83.9 (87.0)	167.8 (174.2)	
Designed feeding water temperature		°C 20.0 104.0 ^a (20.0 ^b)												
Thermal Efficiency		% ≥99												
Rated Gas Consumption		Nm ³ /h	151.5	227.3	303.0	378.8	454.6	606.1	658.9 ^a (757.6 ^b)	790.7 ^a (909.1 ^b)	988.4 ^a (1136.4 ^b)	1317.8 ^a (1515.2 ^b)	2635.6 ^a (3030.4 ^b)	
Gas Pressure		KPa	10~25							20~35				
Pipe Caliber	Gas Caliber		mm	DN50	DN65	DN65	DN80	DN80	DN80	DN100	DN125	DN150	DN150	2- DN150
	Main steam valve caliber		mm	DN65	DN100	DN100	DN125	DN125	DN125	DN150	DN150	DN200	DN200	2- DN200
	Inlet caliber		mm	DN50	DN50	DN50	DN50	DN50	DN50	DN50	DN50	DN80	DN80	2- DN80
	Drain valve caliber		mm	DN25	DN25	DN25	DN25	DN25	DN25	DN25	DN25	DN25	DN25	2- DN25
	Blowdown valve caliber		mm	DN40	DN40	DN40	DN40	DN40	DN40	DN40	DN40	2- DN40	2- DN40	4- DN40
	Safety valve caliber		mm	2- DN32	2- DN50	2- DN50	2- DN65	2- DN65	2- DN65	2- DN80	2- DN80	2- DN100	2- DN100	4- DN100
	Chimney caliber		mm	DN350	DN500	DN500	DN600	DN600	DN600	DN800	DN800	900 ×1200	900 ×1200	2-900 ×1200
	Chimney flange	Inner diameter ϕ	mm	379	508	508	608	608	608	808	808	890 ×1190	890 ×1190	2-890 ×1190
Outer diameter ϕ		mm	470	600	600	700	700	700	900	900	1000 ×1300	1000 ×1300	2-1000 ×1300	
Transportation weight		T	7.2	9.6	9.7	13.4	13.4	13.4	16.3	18.4	24.6	30.5	61.5	
Operating weight		T	8.9	12.1	12.2	16.7	16.8	16.9	21.0	23.8	31.3	38.9	78.5	
Boiler water content		m ³	1.2	1.5	1.6	2.2	2.3	2.4	2.9	3.5	3.6	4.8	9.6	

Standard parameters for rated operating conditions:
1.Design ambient temperature 20°C, altitude ≤ 500m, without air preheater;
2. The listed natural gas is calculated based on the low calorific value: 8600kcal/Nm³;
3.The gas consumption and efficiency of 10t/h and above are converted values.
a: 104°C Water supply conditions, b: 20 °C Water supply conditions;

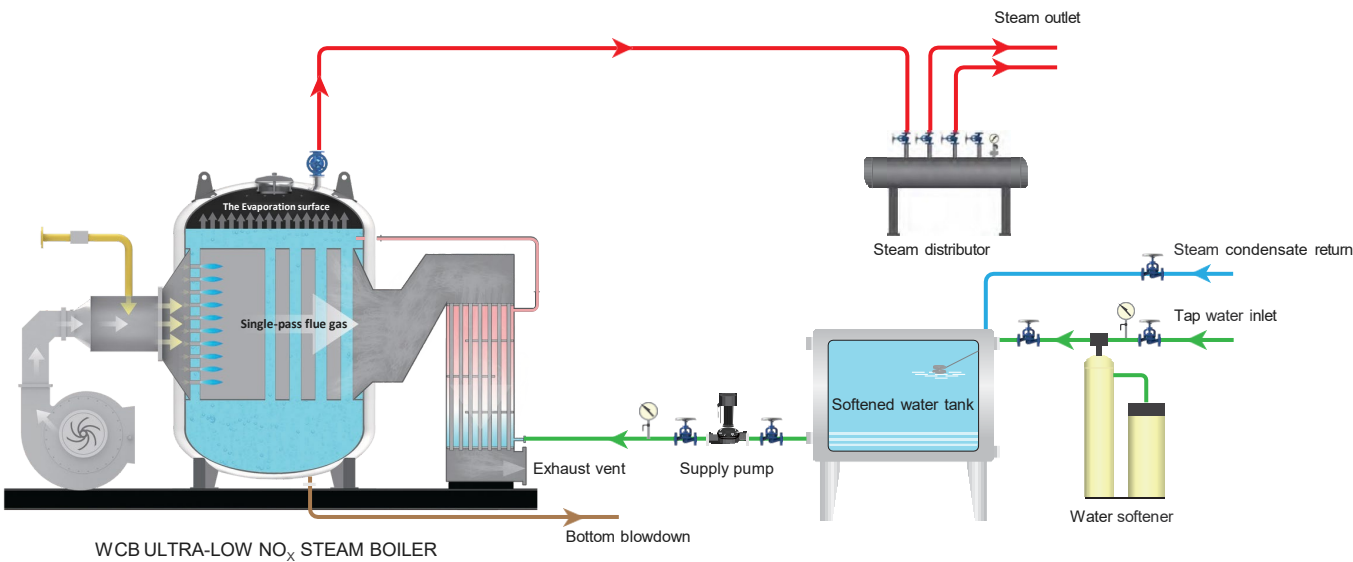
4. Since the smoke contains a certain amount of condensate, it is recommended to use stainless steel chimneys;
5. Boiler model description:
LSS 10 - 1.25 - Q
Q: Fuel type gas
1.25: Rated steam pressure (MPa)
10: Rated Output (t/h)
LSS: Vertical water-tube

Dimension (mm)

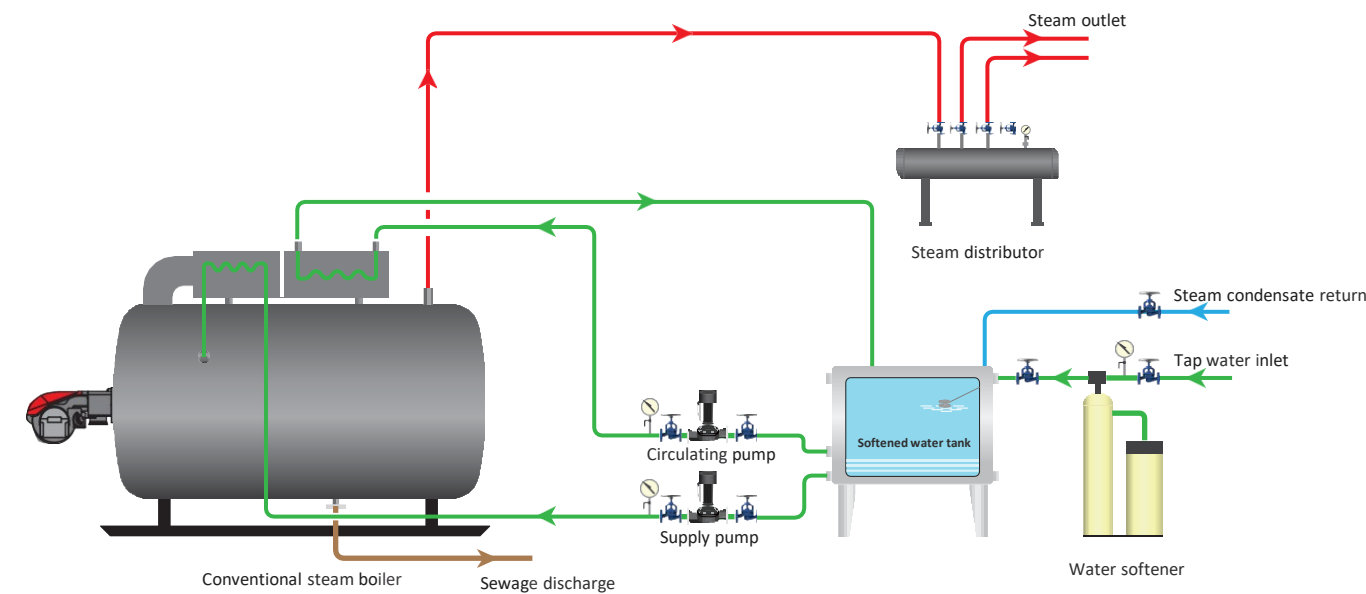
Model	A(L)	B(W)	C(H)	A1	B1	C1
LSS2	4750	2160	3700	4320	1740	3185
LSS3	5250	2460	3960	4820	2040	3310
LSS4	5250	2460	3960	4820	2040	3310
LSS5	5650	2680	4120	5220	2240	3420
LSS6	5650	2680	4120	5220	2240	3420
LSS8	5650	2680	4120	5220	2240	3420
LSS10	6700	2960	4200	6270	2540	3500
LSS12	6950	3200	4300	6520	2740	3600
LSS15	7750	4000	4420	7540	3140	3570
LSS20	8300	4000	4500	8040	3140	3650
LSS40	8300	7300	4500	8040	6540	3650



Steam boiler system flow chart



Liju boiler system flow chart



Conventional horizontal boiler system flow chart

Modular Steam Supply System

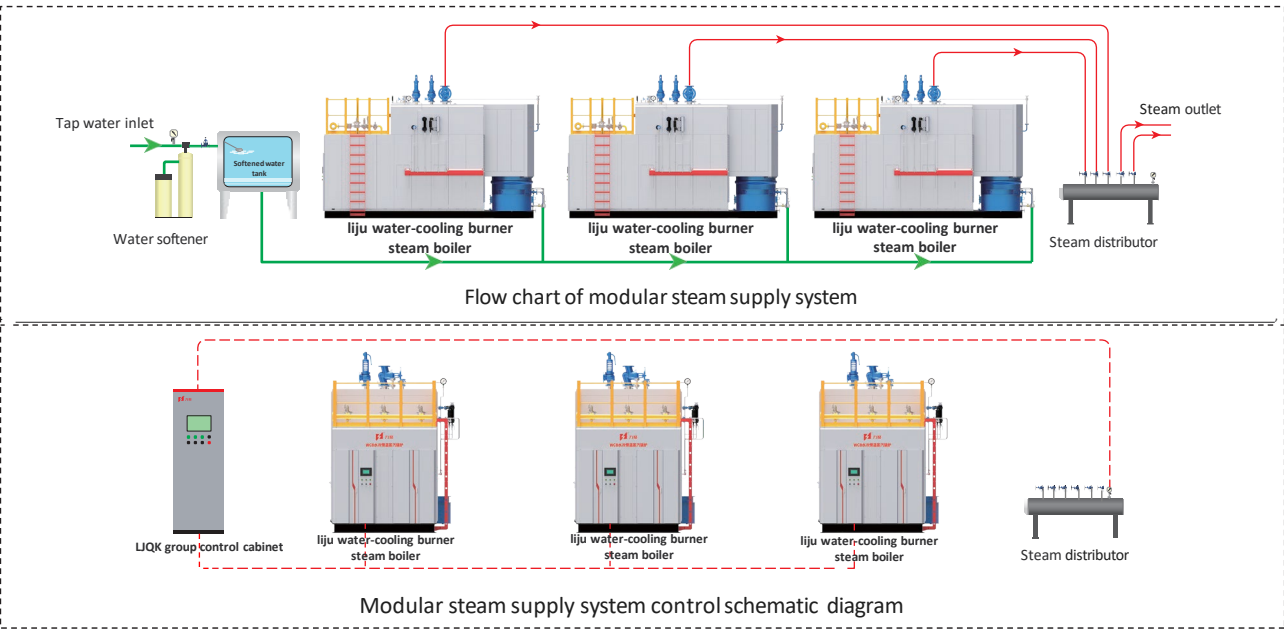
For users with a large amount of steam, such as district heating in a industrial park, medium and large scale chemical plants, lithium battery factory and other users, due to the fluctuation in the steam load (many uncertainties), it is recommended to apply modular steam supply system, with multiple small-tonnage boilers instead of large-tonnage boilers, can greatly save the initial investment, reduce operating costs, and reduce the number of operators and managers.

For example: 100 t/h steam load application, a typical setup for conventional boiler design, 3 sets of 50 t/h steam boilers (Two for use, one for backup), a total tonnage of 150 tons. While it takes 5-6 sets of 20 t/h boilers with LIJU modular steam boilers. The total tonnage is only up to 120 tons. The area of the boiler room can be reduced by 1/3, and the height can also be reduced by 30%. It can not only reduce the initial investment of boiler equipment, but also reduce the initial installation fee of the gas pipeline and the cost of land construction costs.

For district heating in a industrial park and phased projects, the number of boilers can also be gradually increased according to the increasing steam load to improve investing fund utilization.



Conventional Large Steam Boiler Solutions LIJU Modular Steam Boiler Solution



LIJU WCB steam boiler adopts WCB combustion technology, compact design (only 2/3 of the conventional boiler footprint), less water content (only 1/6 of the conventional boiler), and fast load response, which makes modular steam supply system possible.

LIJU RCS-type modular boiler control system developed adopts intellectual logic technology. It can automatically adjust the operating load and number of modules according to the steam load to achieve the highest possible operational efficiency of the boilers and achieve the purpose of energy saving.

Applications

▼ LSS 10 - 1.6 - Q × 5



▼ LSS 12 - 2.45 - Q × 5



▼ LSS 10 - 1.6 - Q



▼ LSS 6 - 1.25 - Q × 3



Applications

▼ LSS 20 - 1.6 - Q & LSS 10 - 1.6 - Q × 2



▼ LSS 6 - 1.25 - Q × 4



▼ LSS 8 - 1.6 - Q × 3



▼ LSS 10 - 2.45 - Q × 4



Applications

▼ LSS 6 - 1.6 - Q & LSS 8 - 1.6 - Q



▼ LSS 8 - 1.6 - Q × 3



▼ LSS 6 - 1.25 - Q × 2



▼ LSS 4 - 1.25 - Q × 3



Steam engineering data table

Saturated steam pipeline selection table															Unit: kg/hr
Gauge Pressure bar	Velocity m/s	32 mm	40 mm	50 mm	65 mm	80 mm	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm	350 mm	400 mm	500 mm
4.0	15	116	181	283	478	724	1132	1768	2546	4527	7073	10185	13863	18107	28292
	25	193	302	472	797	1207	1886	2947	4244	7544	11788	16975	23105	30178	47153
	40	309	483	754	1275	1931	3018	4715	6790	12071	18861	27160	36968	48284	75444
6.0	15	159	249	389	657	995	1555	2430	3499	6220	9719	13996	19049	24881	38877
	25	265	415	648	1095	1659	2592	4050	5831	10367	16199	23326	31749	41468	64794
	40	425	663	1037	1752	2654	4147	6479	9330	16587	25918	37321	50799	66349	103671
8.0	15	202	316	494	834	1263	1974	3084	4442	7896	12338	17766	24182	31584	49350
	25	337	526	823	1390	2106	3290	5141	7403	13160	20563	29610	40303	52640	82250
	40	539	842	1316	2224	3369	5264	8225	11844	21056	32900	47376	64484	84224	131600
10.0	15	245	382	598	1010	1530	2391	3735	5379	9562	14941	21515	29285	38250	59765
	25	408	637	996	1683	2550	3984	6226	8965	15937	24902	35859	48808	63750	99609
	40	653	1020	1594	2693	4080	6375	9961	14344	25500	39843	57375	78093	101999	159374
12.0	15	287	449	701	1185	1795	2805	4383	6312	11221	17533	25247	34364	44884	70131
	25	479	748	1169	1975	2992	4675	7305	10520	18701	29221	42078	57273	74806	116884
	40	766	1197	1870	3161	4788	7481	11688	16831	29922	46754	67325	91637	119690	187015
16.0	15	372	582	909	1536	2327	3635	5680	8180	14542	22721	32719	44534	58167	90886
	25	620	969	1515	2560	3878	6059	9467	13633	24236	37869	54531	74223	96945	151476
	40	993	1551	2424	4096	6204	9694	15148	21813	38778	60590	87250	118757	155112	242362
20.0	15	457	715	1117	1887	2859	4467	6980	10051	17869	27920	40205	54723	71475	111680
	25	762	1191	1861	3146	4765	7445	11633	16752	29781	46533	67008	91205	119125	186133
	40	1220	1906	2978	5033	7624	11913	18613	26803	47650	74453	107213	145929	190601	297814

For long-distance pipelines, in order to avoid noise, erosion and excessive pressure drop, the flow rate is usually selected at 15m/s.
For short branch pipes, the steam flow rate can be selected at 25-30m/s.

Steam Table (public SI unit)											
Gauge pressure bar	Temepature °C	Specific volume m³/kg	Sensible heat (ht) kJ/kg	Latent heat (ht) kJ/kg	Total heat (ht) kJ/kg	Gauge pressure bar	Temepature °C	Specific volume m³/kg	Sensible heat (ht) kJ/kg	Latent heat (ht) kJ/kg	Total heat (ht) kJ/kg
1.0	120.42	0.881	505.6	2201.1	2706.7	16.0	204.38	0.117	872.3	1923.4	2795.7
2.0	133.69	0.603	562.2	2163.3	2725.5	17.0	207.17	0.110	885.0	1912.1	2797.1
3.0	143.75	0.461	605.3	2133.4	2738.7	18.0	209.90	0.205	897.2	1901.3	2798.5
4.0	151.96	0.374	640.7	2108.1	2748.8	19.0	212.47	0.100	909.0	1890.5	2799.5
5.0	158.92	0.315	670.9	2086.0	2756.9	20.0	214.93	0.0994	920.3	1880.5	2800.5
6.0	164.19	0.277	693.6	2067.0	2760.6	21.0	217.35	0.0960	931.3	1870.1	2801.4
7.0	170.50	0.240	721.4	2047.7	2769.1	22.0	219.65	0.0868	941.9	1860.1	2802.0
8.0	175.43	0.215	743.1	2030.9	2774.0	23.0	221.85	0.0832	952.2	1850.4	2802.6
9.0	179.97	0.194	763.0	2015.1	2778.1	24.0	224.02	0.0797	962.2	1840.9	2803.1
10.0	184.13	0.177	781.6	2000.1	2781.7	25.0	226.12	0.0768	972.1	1831.4	2803.5
11.0	188.02	0.163	798.8	1986.0	2784.8	26.0	228.15	0.0740	981.6	1822.2	2803.8
12.0	191.68	0.151	815.1	1972.5	2787.6	27.0	230.14	0.0714	990.7	1813.3	2804.0
13.0	195.10	0.141	830.4	1959.6	2790.0	28.0	232.05	0.0689	999.7	1804.4	2804.1
14.0	198.35	0.132	845.1	1947.1	2792.2	29.0	233.93	0.0666	1008.6	1795.6	2804.2
15.0	201.45	0.124	859.0	1935.0	2794.0	30.0	235.78	0.0645	1017.0	1787.0	2804.1

Cylinder Selection Table												
Operating Condition Steam gauge pressure (MPa)	Cylinder diameter D (mm)											
	200	250	300	350	400	500	600	700	800	900	1000	1200
Standard state steam quantity (t/h)												
0.4	3.28	4.72	6.78	9.23	12.06	18.84	27.13	36.93	48.24	61.04	75.37	108.58
0.6	4.51	6.49	9.31	12.69	16.57	25.89	37.29	50.74	66.29	83.89	103.58	149.21
0.8	5.73	8.24	11.82	16.11	21.04	32.86	47.34	64.42	84.16	106.50	121.49	189.41
1.0	6.93	9.98	14.32	19.51	25.48	39.80	57.33	78.02	101.92	128.98	159.25	229.38
1.2	8.14	11.71	16.81	22.90	29.91	46.72	67.30	91.58	119.64	151.40	186.94	269.16
1.4	9.34	13.44	19.29	26.28	34.33	53.63	77.25	105.13	137.33	173.79	214.58	308.98
1.6	10.55	15.18	21.78	29.67	38.76	60.54	87.21	118.69	155.05	196.21	242.26	348.82
2.0	13.01	18.60	26.79	36.46	47.63	74.42	107.16	145.85	190.50	241.11	297.66	428.63

Note: 1. Calculation of sub-cylinder diameter: $D=595\sqrt{G/V\rho}$
2. Steam flow rate is calculated according to 10m/s

Where: D- Diameter of split cylinder (mm)
G- Total flow rate of saturated steam through sub-cylinder under standard condition (t/h)
 ρ - Density of saturated steam under working condition (kg/m³)
V- Working condition saturated steam flow rate through the sub-cylinder (m/s)

Commonly used heat unit conversion table						
unit (of measure)	Cal	Kcal	Kgf · m	Btu	kW · h	J
Calorie	1	0.001	0.4272	4.0×10 ⁻³	1.2×10 ⁻⁶	4.1868
Kcal	1000	1	427.2	3.968	1.2×10 ⁻³	4186.8
Kilocalorie	2.342	2.3×10 ⁻³	1	9.3×10 ⁻³	2.7×10 ⁻⁶	9.80665
British thermal unit	252	0.252	107.586	1	2.9×10 ⁻⁴	1055.06
kilowatt-hour	8.6×10 ⁵	859.86	3.7×10 ⁵	3412.1	1	3.6×10 ⁻⁶
joule	0.2399	2.4×10 ⁻⁴	0.10204	9.5×10 ⁻⁴	2.8×10 ⁻⁷	1