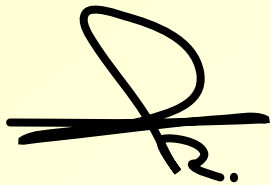


Circulating Fluidized Bed Boiler

Training For SKIC Project



Hangzhou Boiler Group Co., Ltd.

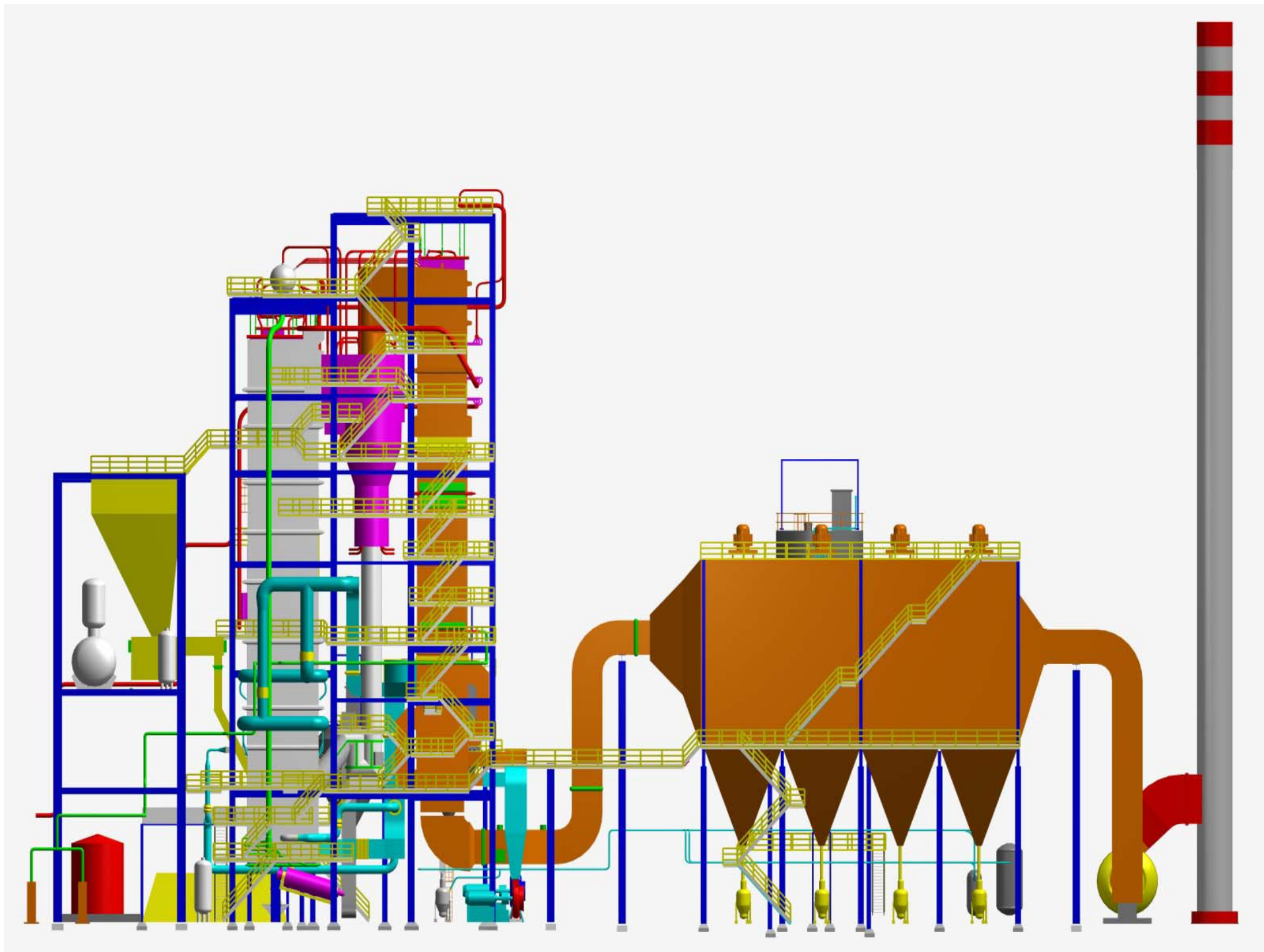
www.facebook.com/BoilerandMechanicalPower

Ye zhong

Design department

Email: yezhang@126.com

www.facebook.com/BoilerandMechanicalPower



Boiler Specifications

Maximum Steam Flow

130t/h

Superheat Steam Outlet Temperature

510°C ⁺⁵₋₁₀

Superheat Steam Outlet Pressure

100bar(g)

Feedwater Temperature

170°C

Ambient Air temperature

30°C

Boiler Main Dimensions

Furnace Width 7200mm

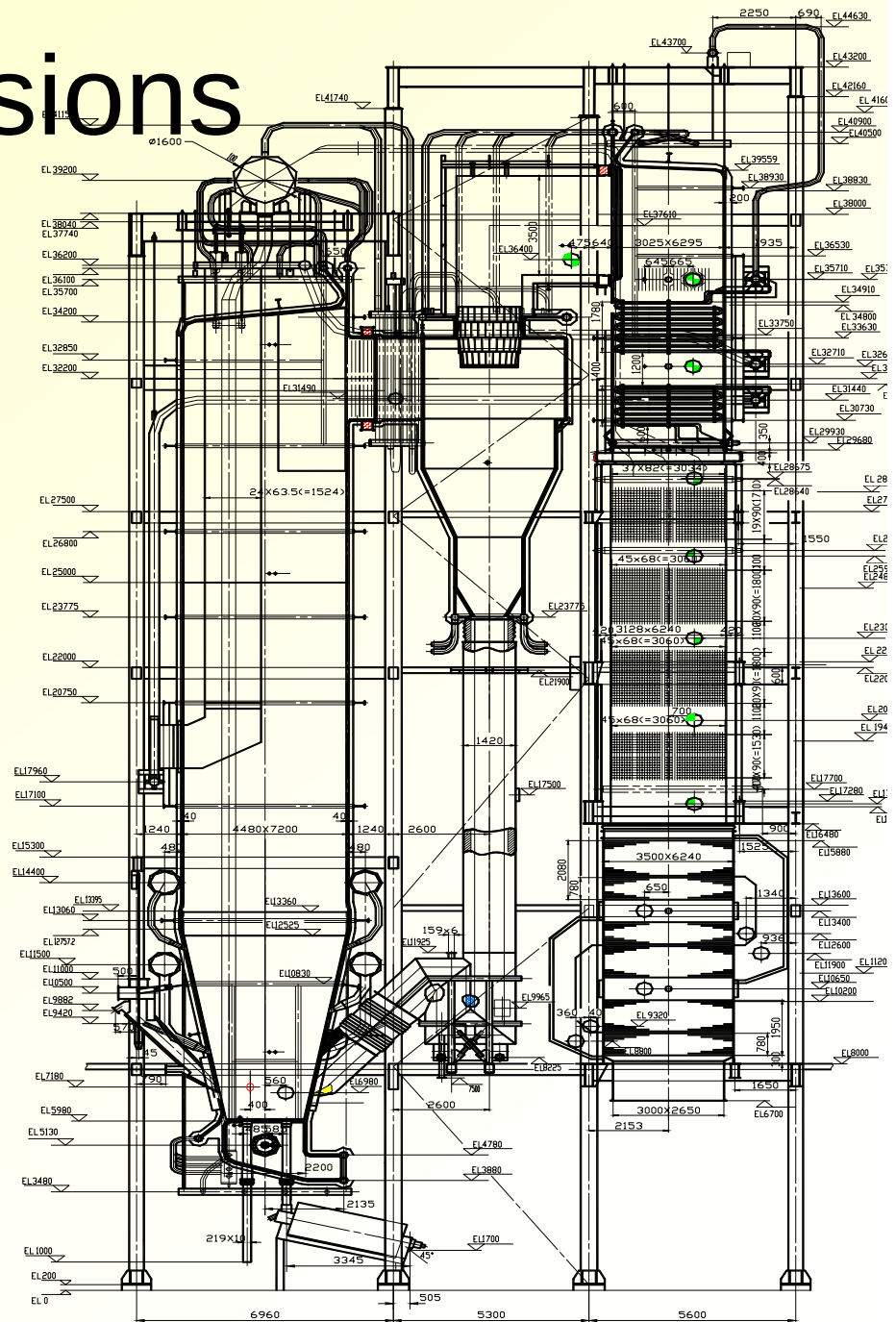
Furnace Depth	4480mm
---------------	--------

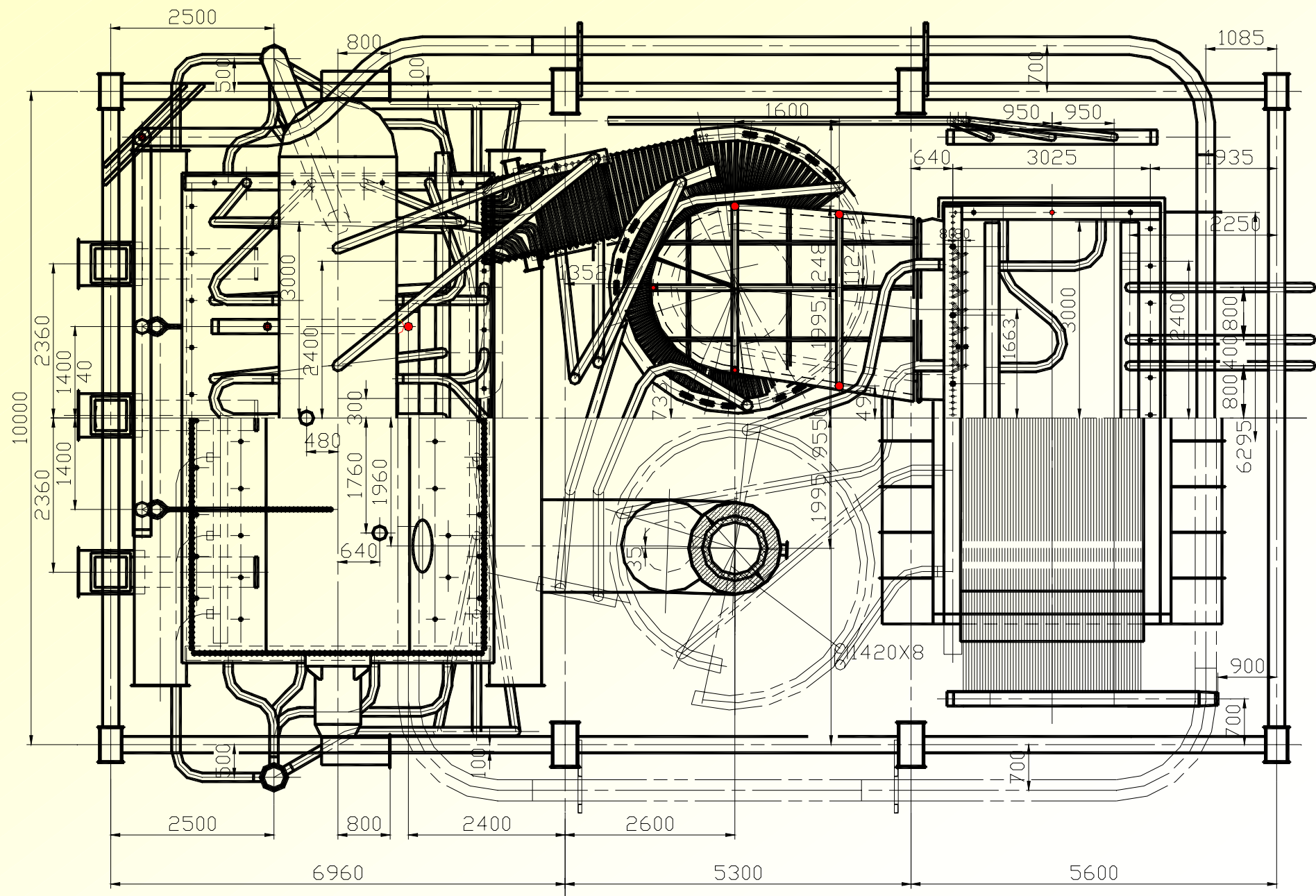
Elevation of Steam Drum CL 39200mm

Elevation of Boiler Top	38040/43200m m
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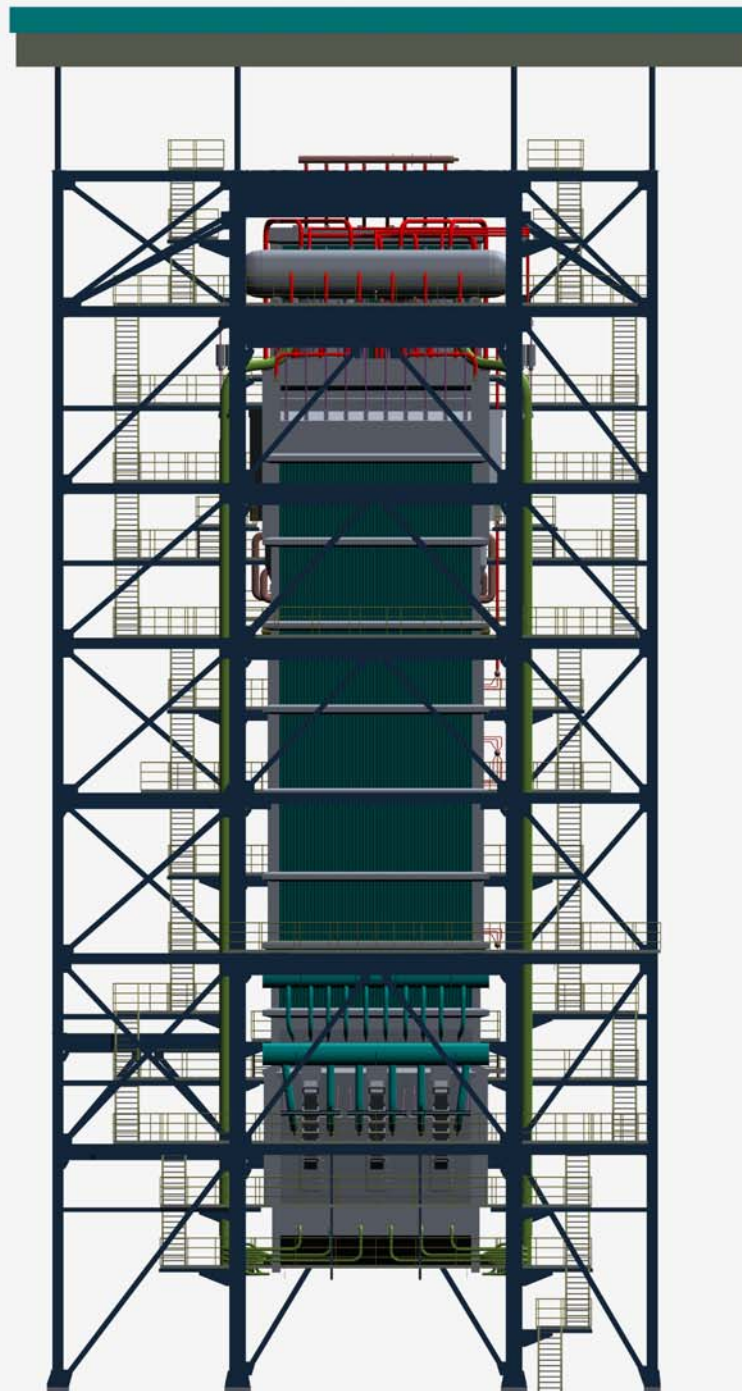
Boiler Width 10000mm

Boiler Depth	17860mm
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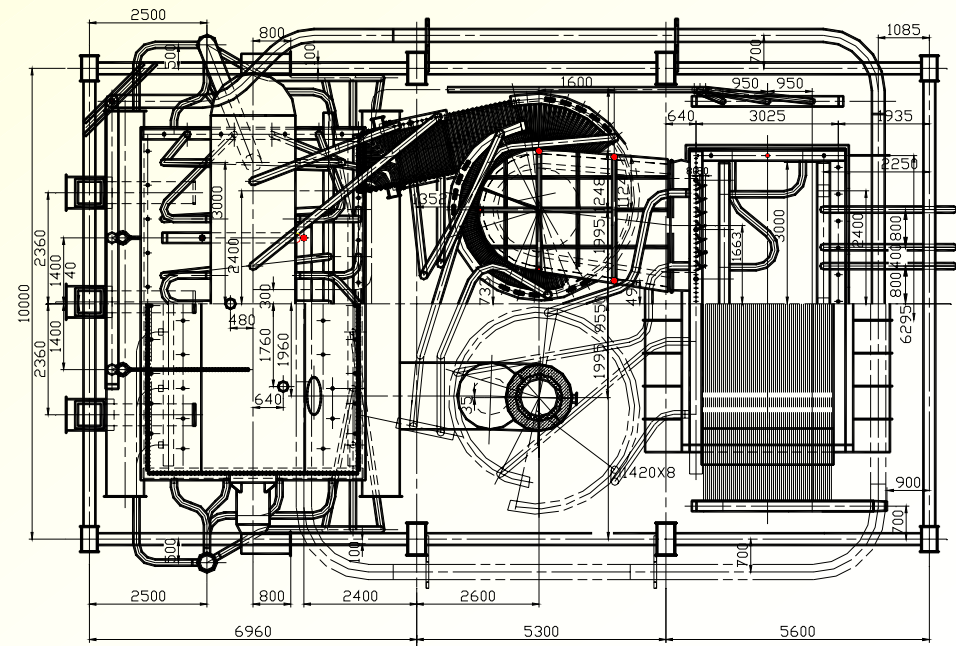
Fuel

	symbol	Design fuel coal2	Check fuel coal1	Check fuel coal3
Carbon	Car	62.21	48.73	62.74
Hydrogen	Har	4.08	3.53	4.76
Oxygen	Oar	6.09	14.03	8.89
Nitrogen	Nar	1.01	0.48	1.02
Sulfur	Sar	0.72	0.11	1.32
Ash	Aar	13.89	3.11	10.25
Moisture	War	13.89	30	11

Other material

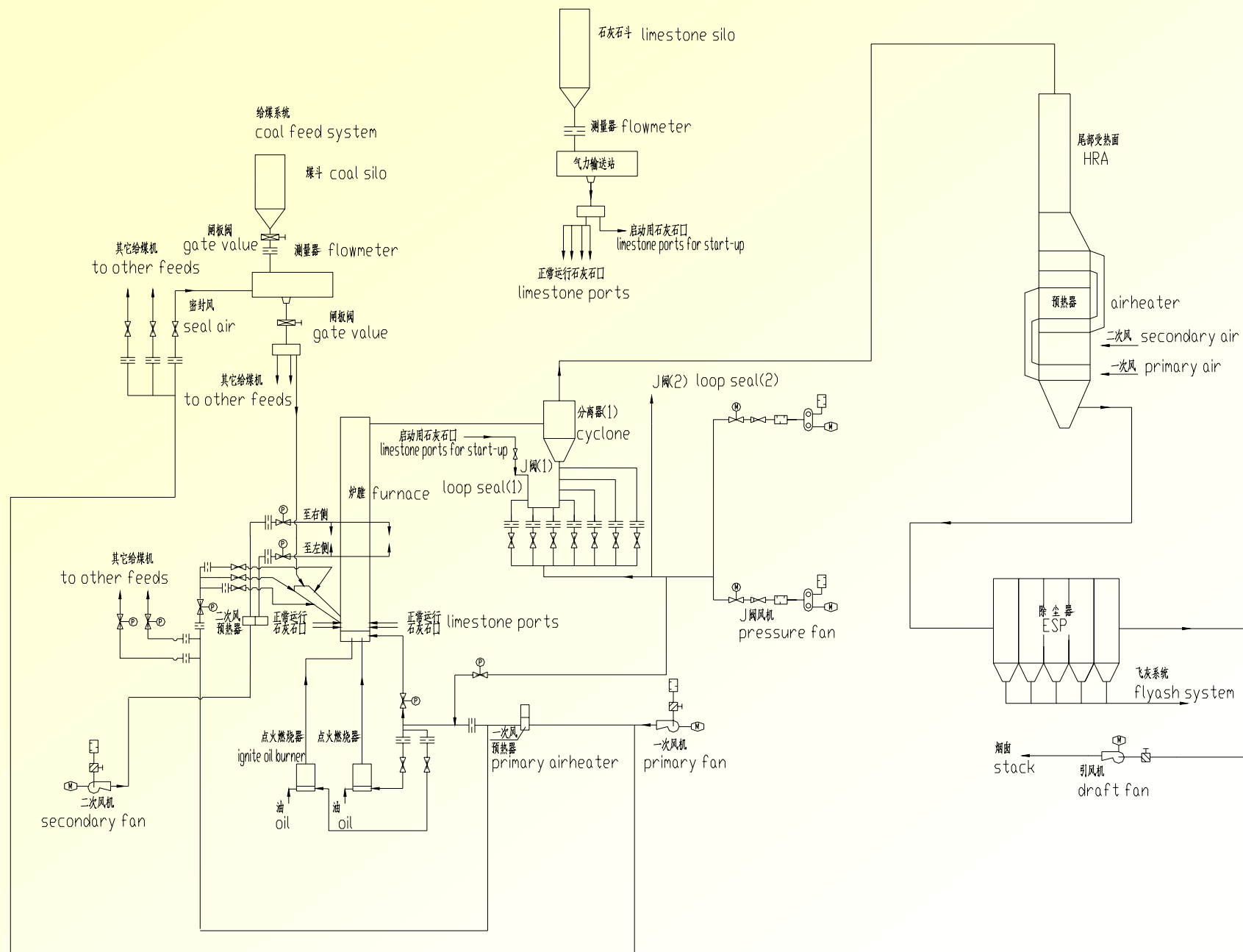
Limestone

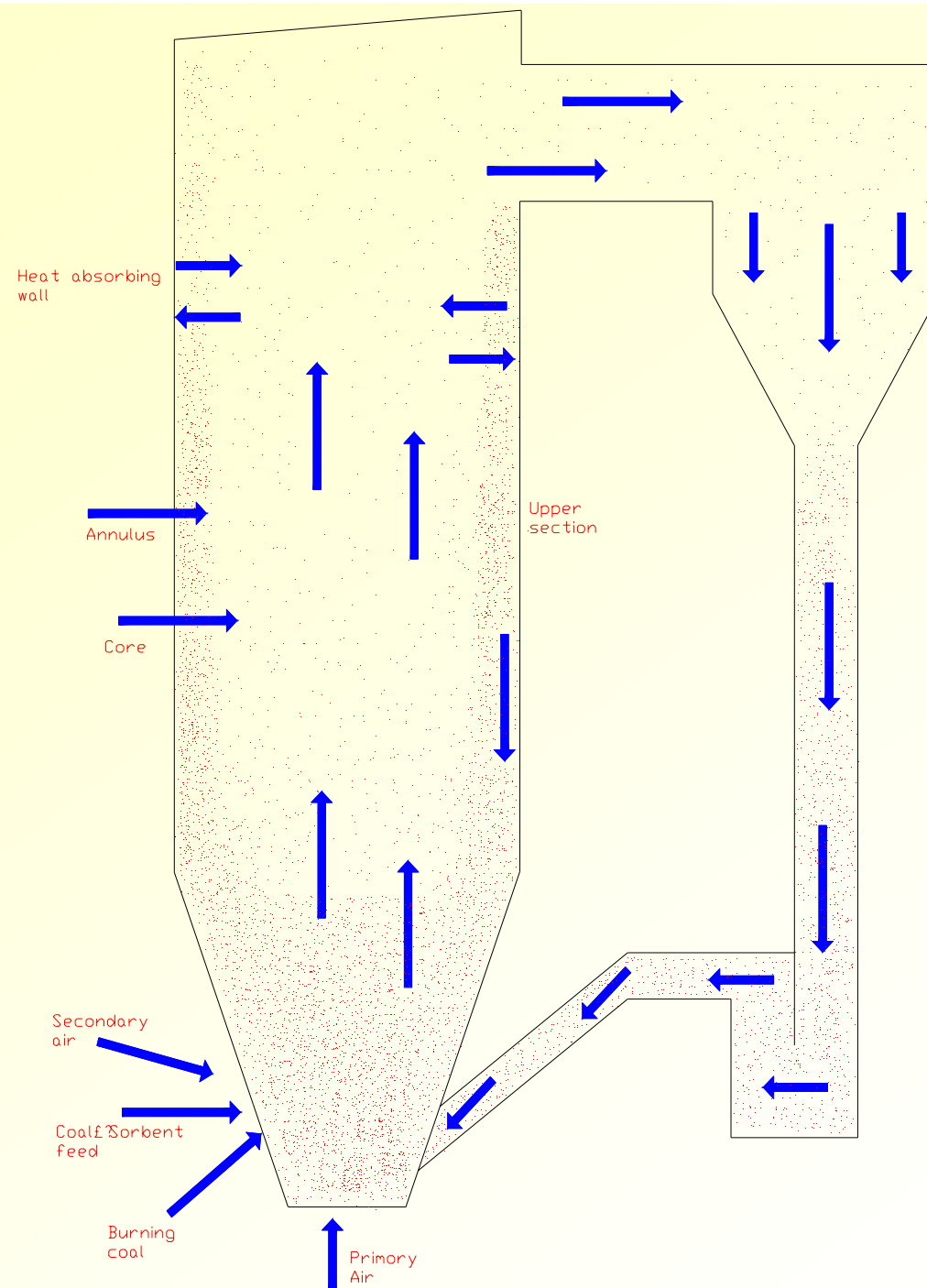
Sand

[illegible]

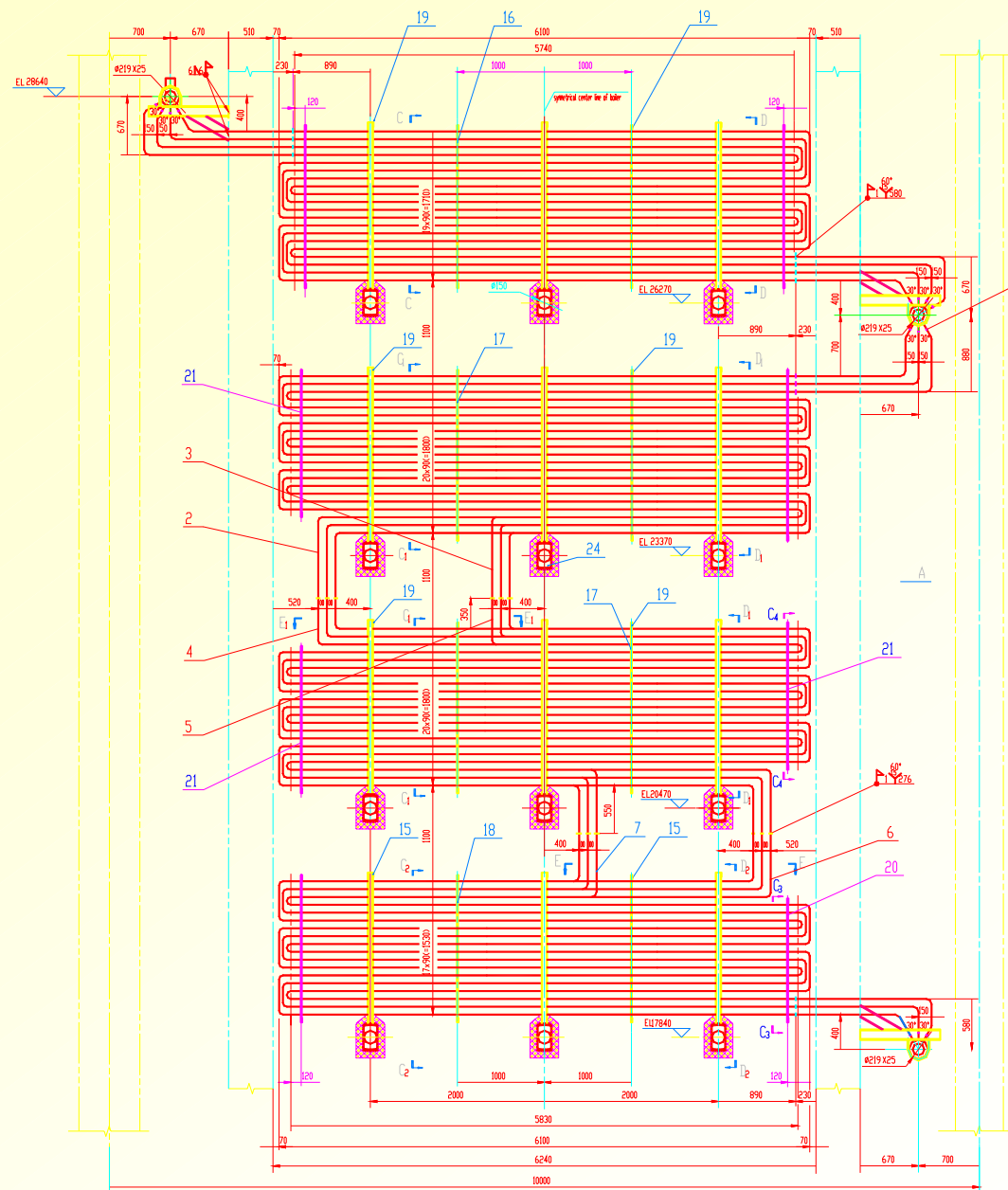
Steam and Water Flow

Air and Gas Flow

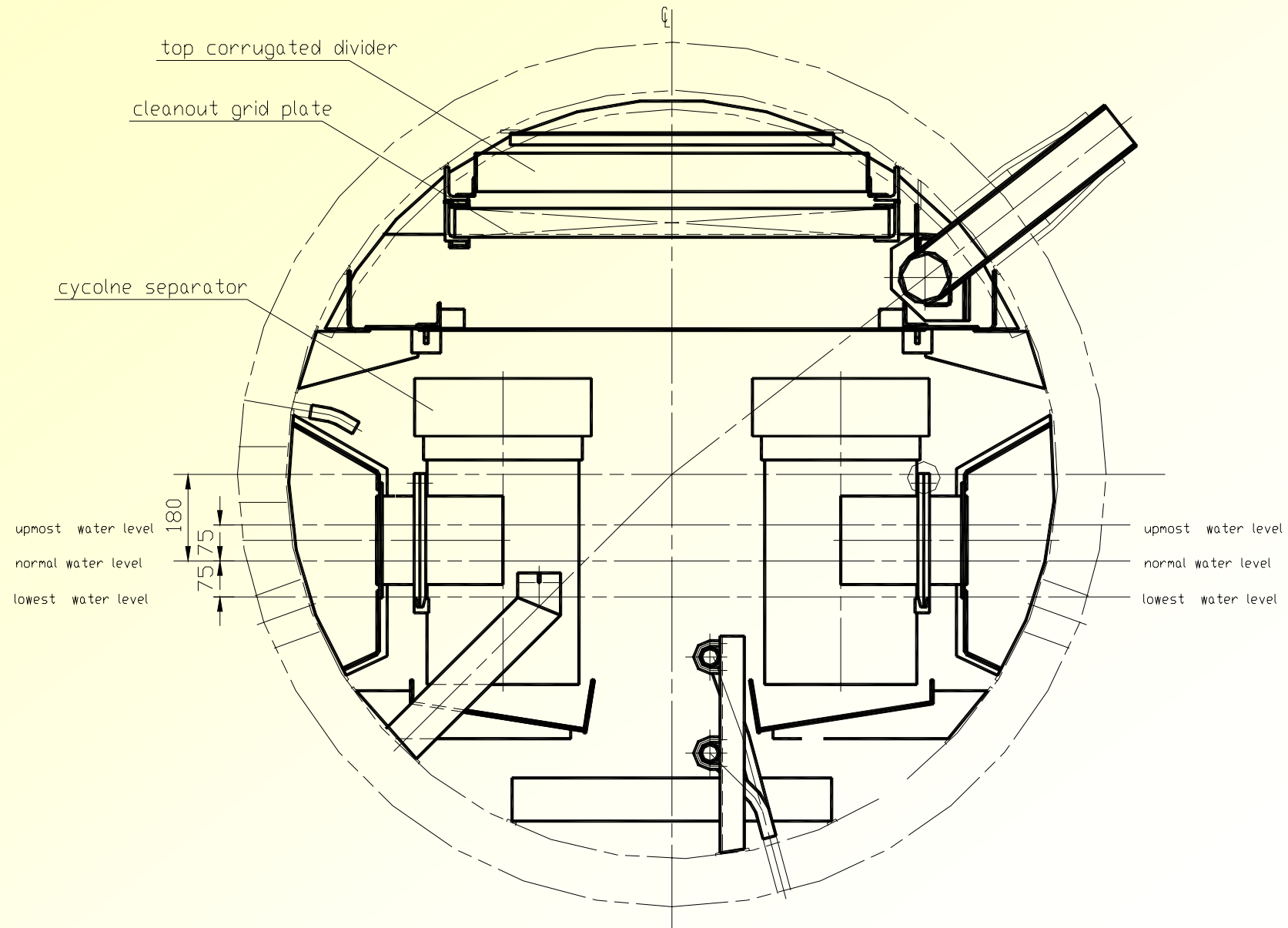


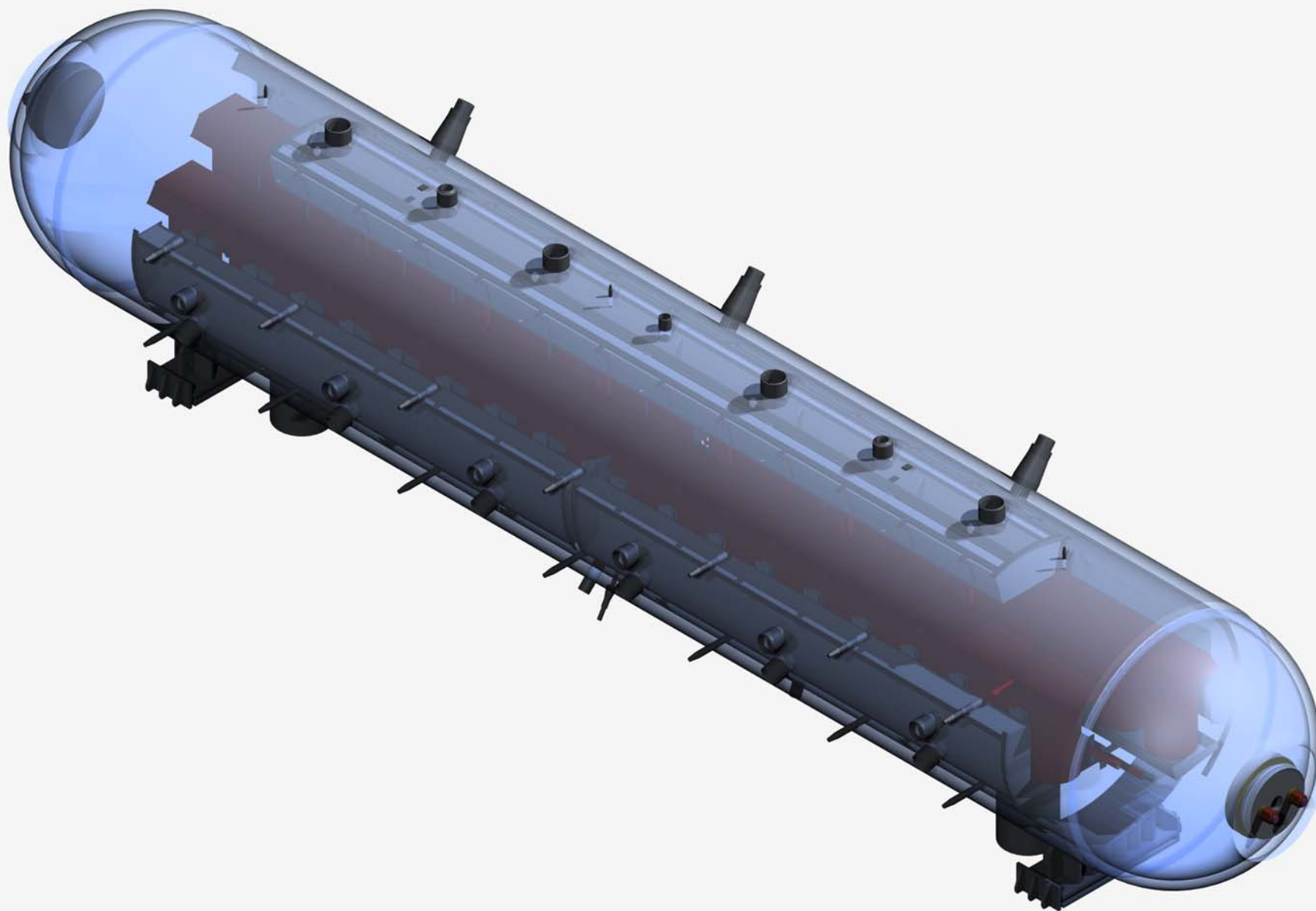


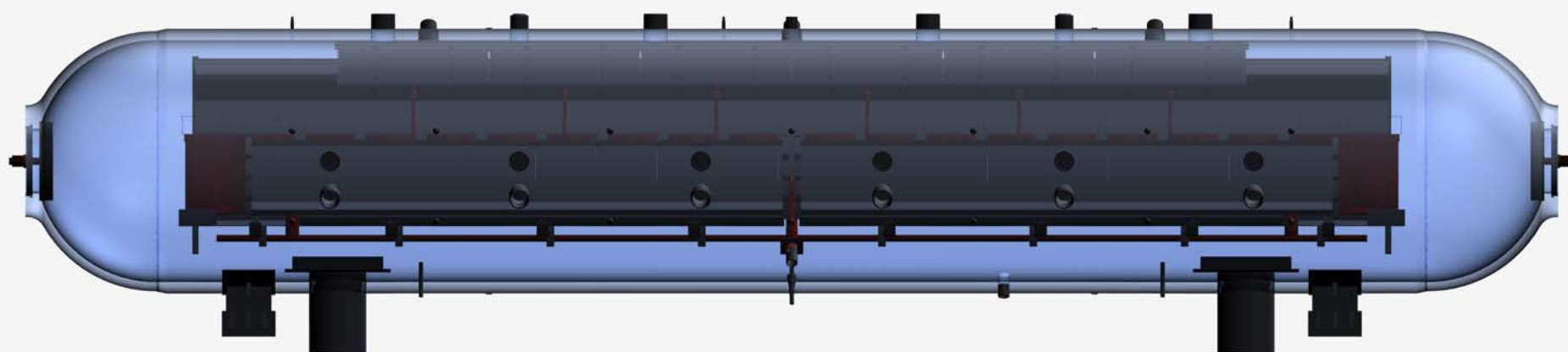
Economizer



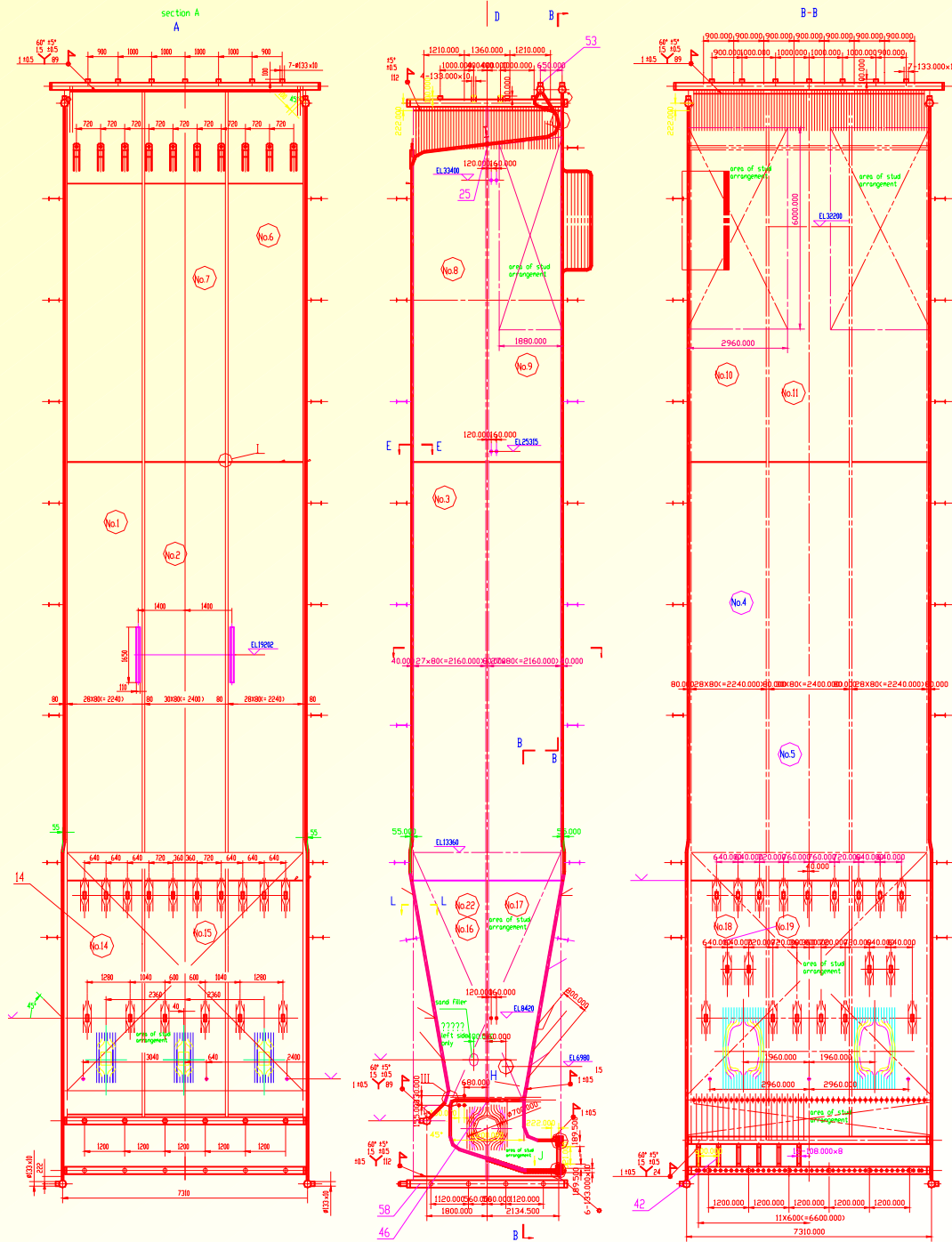
Steam Drum and Drum Internals





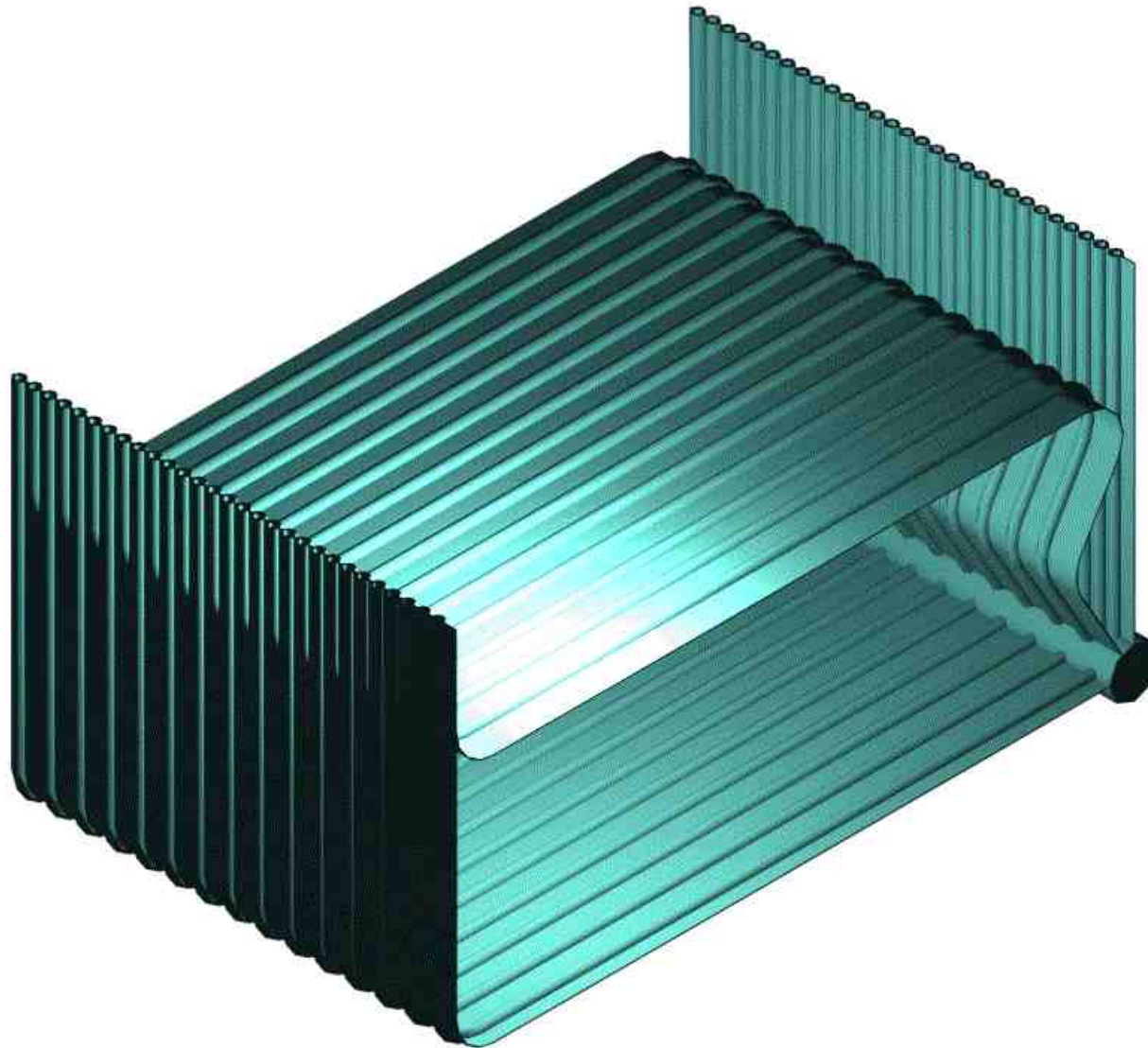


Furnace

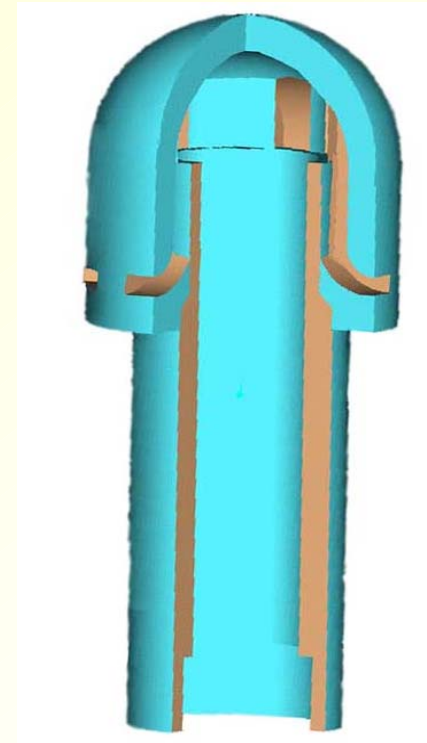
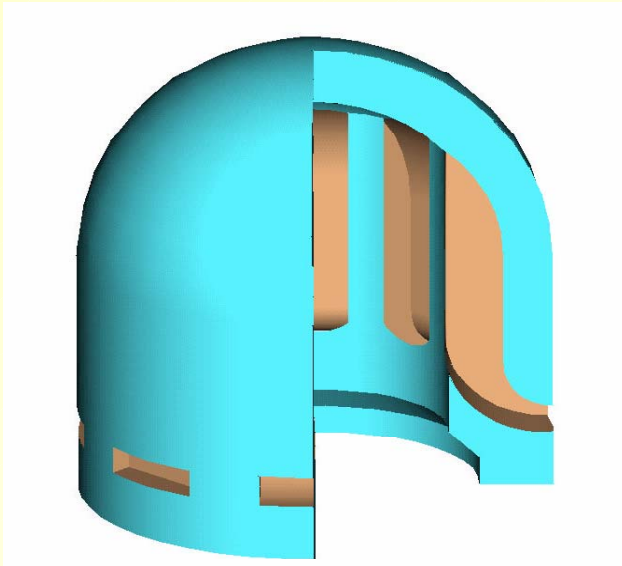


HBG CFB Design Characteristics

- **Water-cooled wind box & air distributor**



HBG CFB Design Characteristics





Cyclone

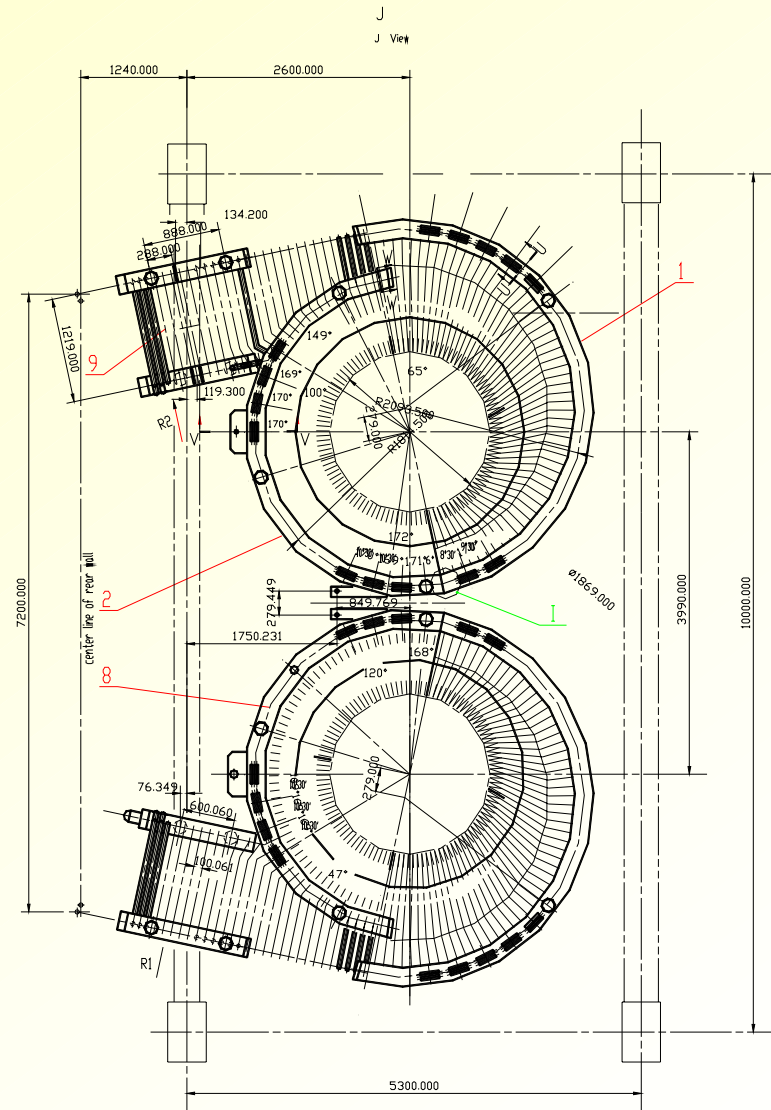
The image displays a technical drawing of a cyclone separator, consisting of a side elevation and a top view.

Side Elevation (Left):

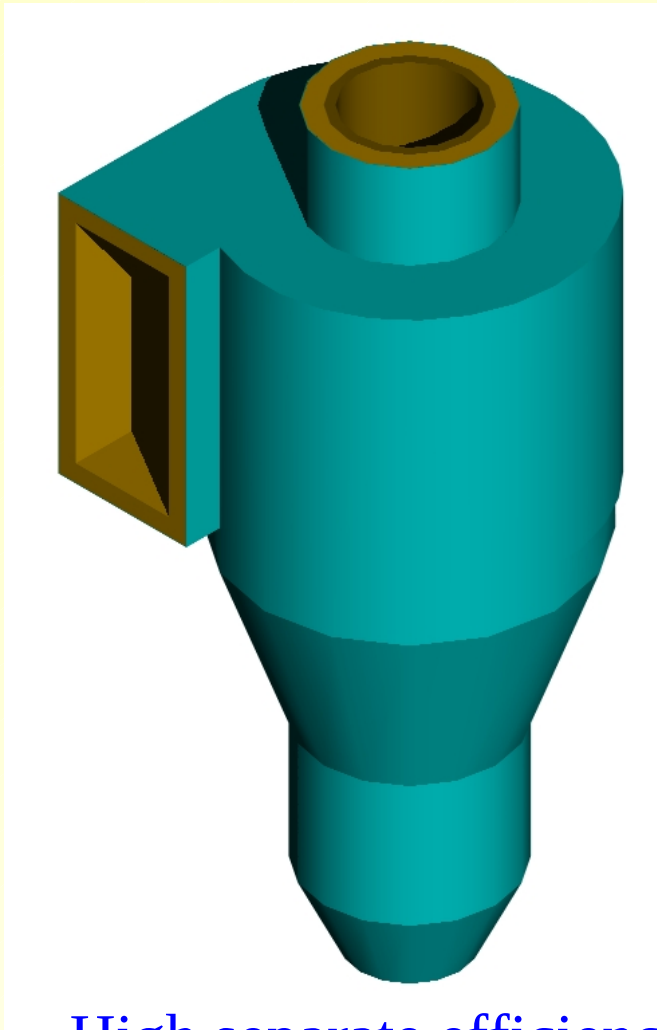
- Overall width: 5300.000
- Top section width: 1869.000
- Height from top to bottom of hopper: 3629.000
- Elevation markers: EL 34370, EL 33660, EL 30738, EL 29825, EL 29015, EL 25975
- Structural details include a hopper at the bottom, a cylindrical body, and a conical top.

Top View (Right):

- Overall width: 5300.000
- Overall height: 10000.000
- Section width: 1240.000
- Section height: 2600.000
- Internal dimensions and angles are provided for the circular cross-sections.
- Red annotations 1, 2, 8, and 9 highlight specific features.



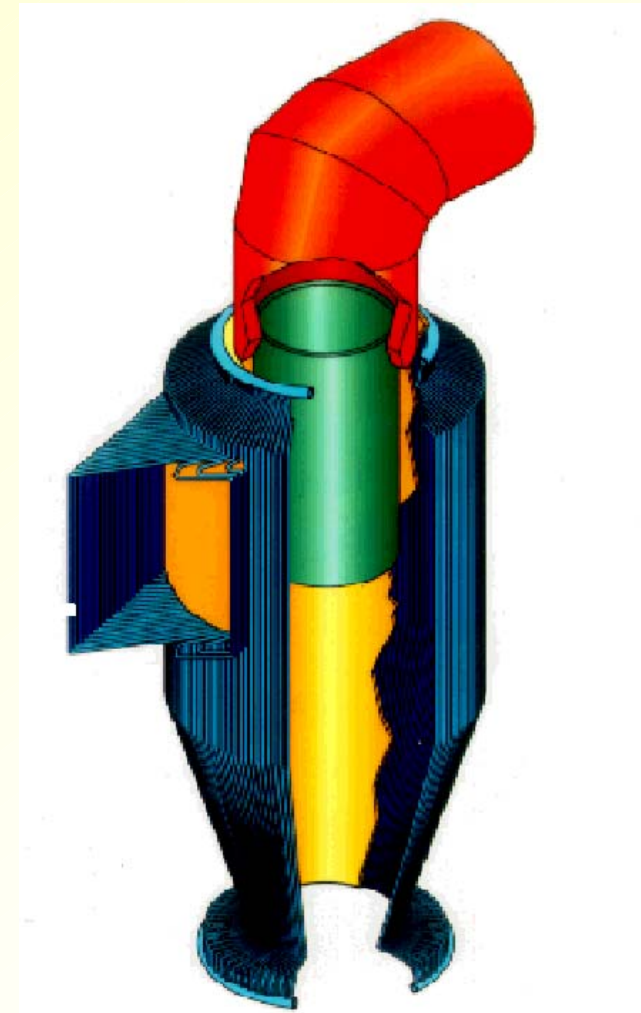
Separator design



High separate efficiency

More maintenance work

Non-cooling configuration

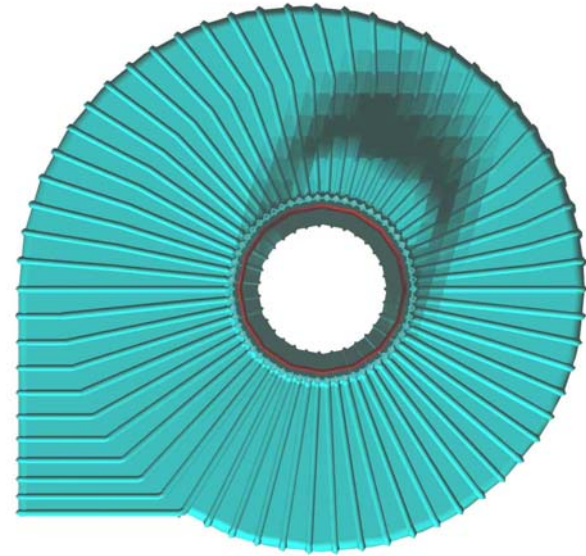
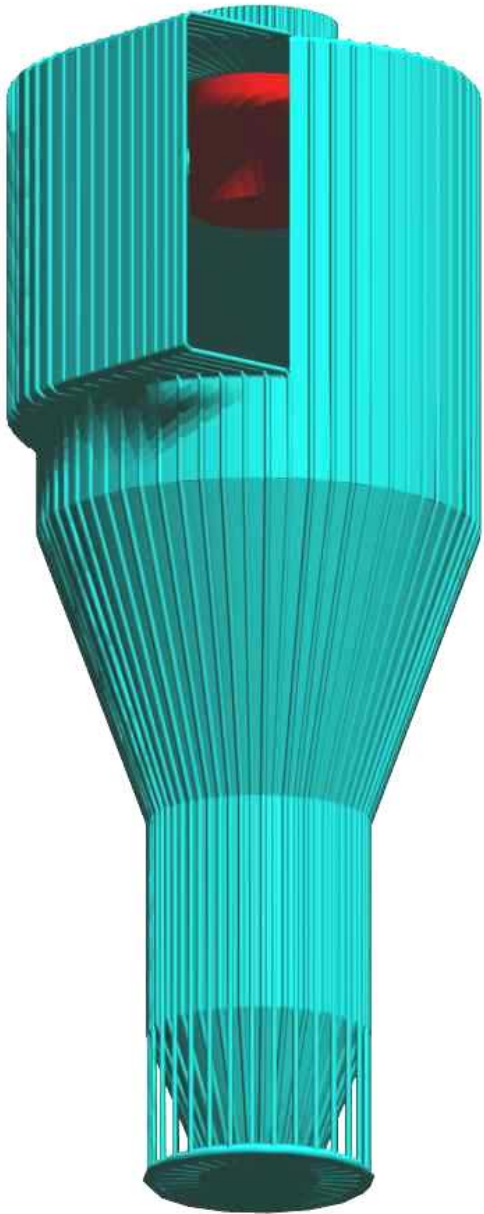


Low separate efficiency

High reliable

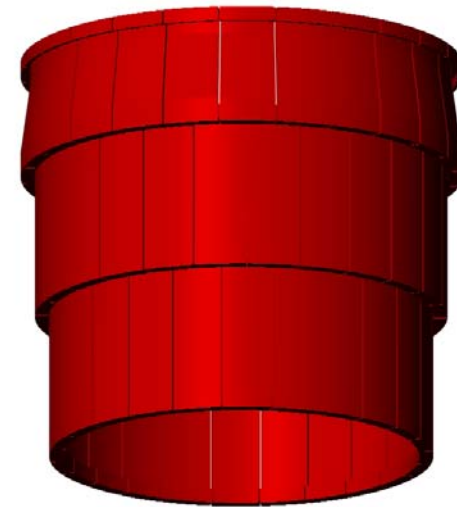
cooling configuration

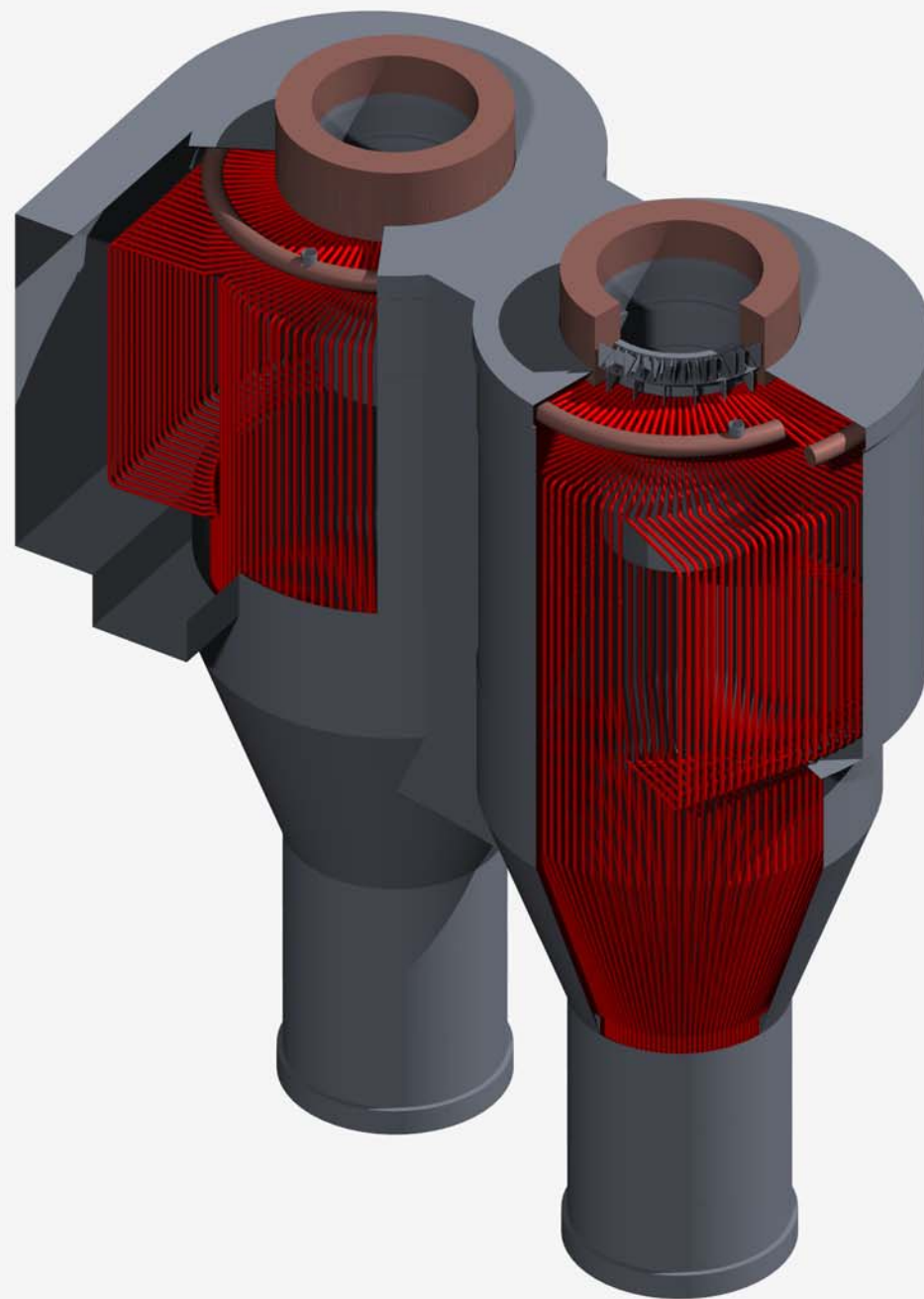
Steam-cooled volute type cyclone



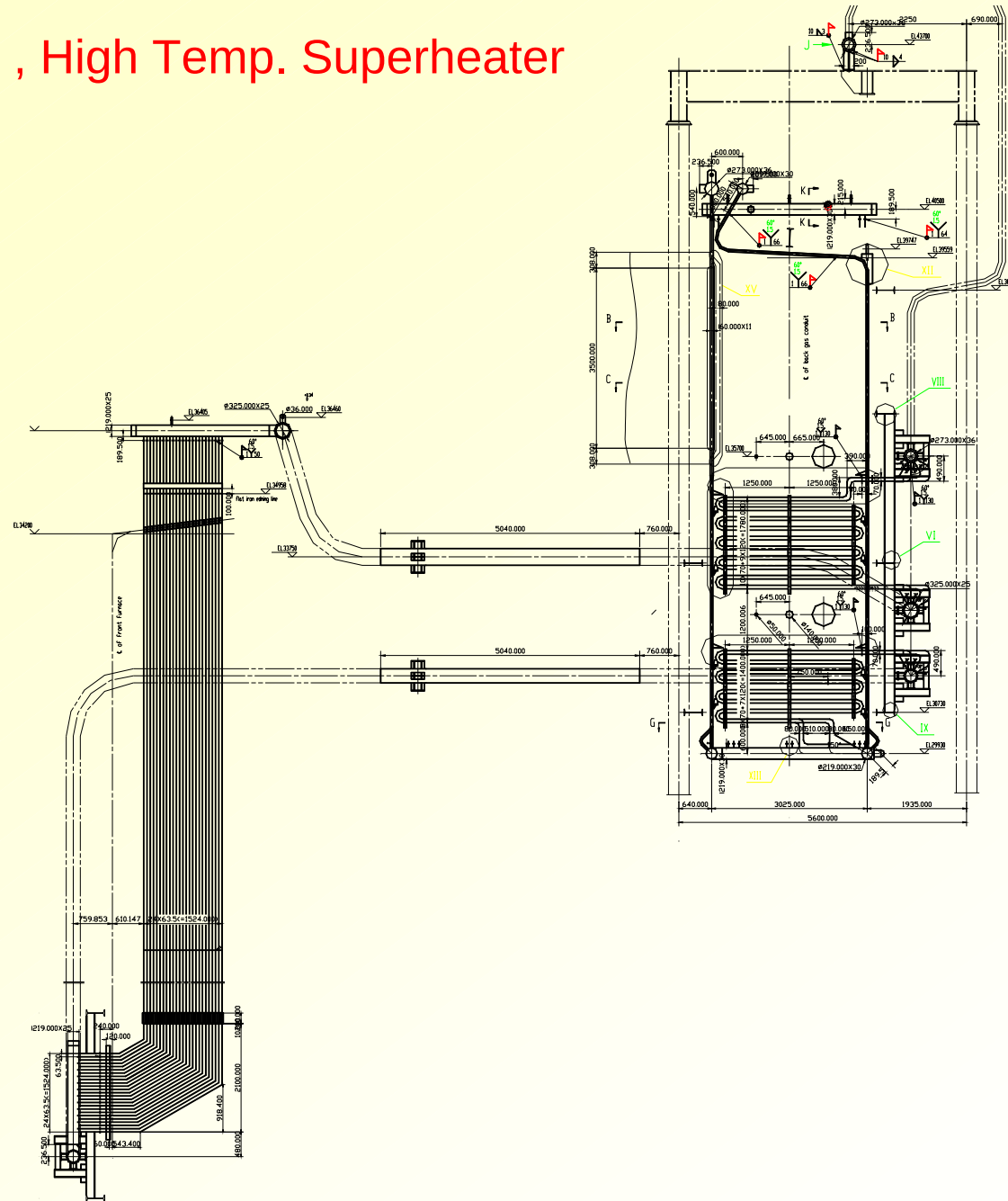
HBG cyclone

More high efficiency
More high reliable

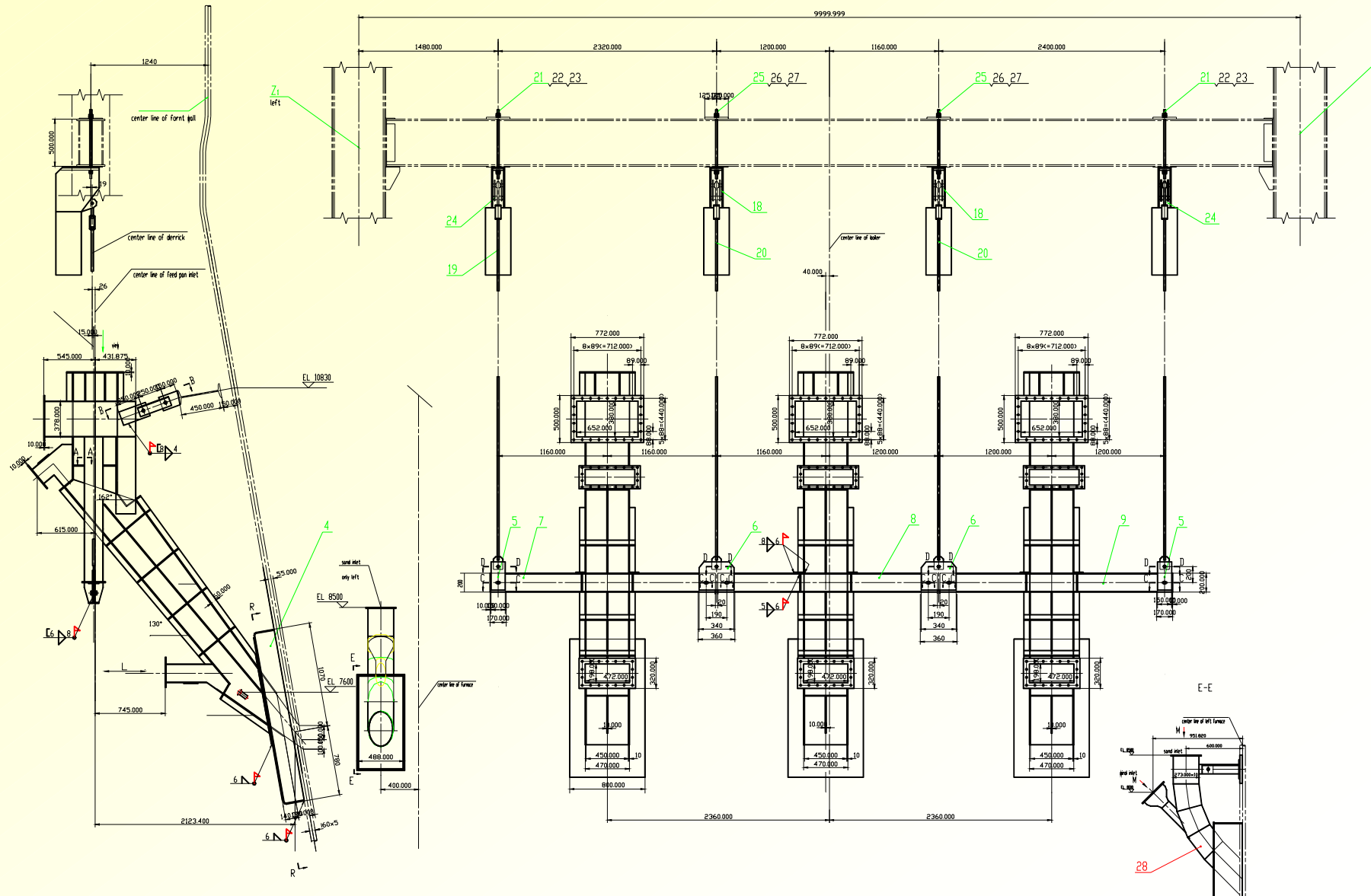




Wing Wall , High Temp. Superheater

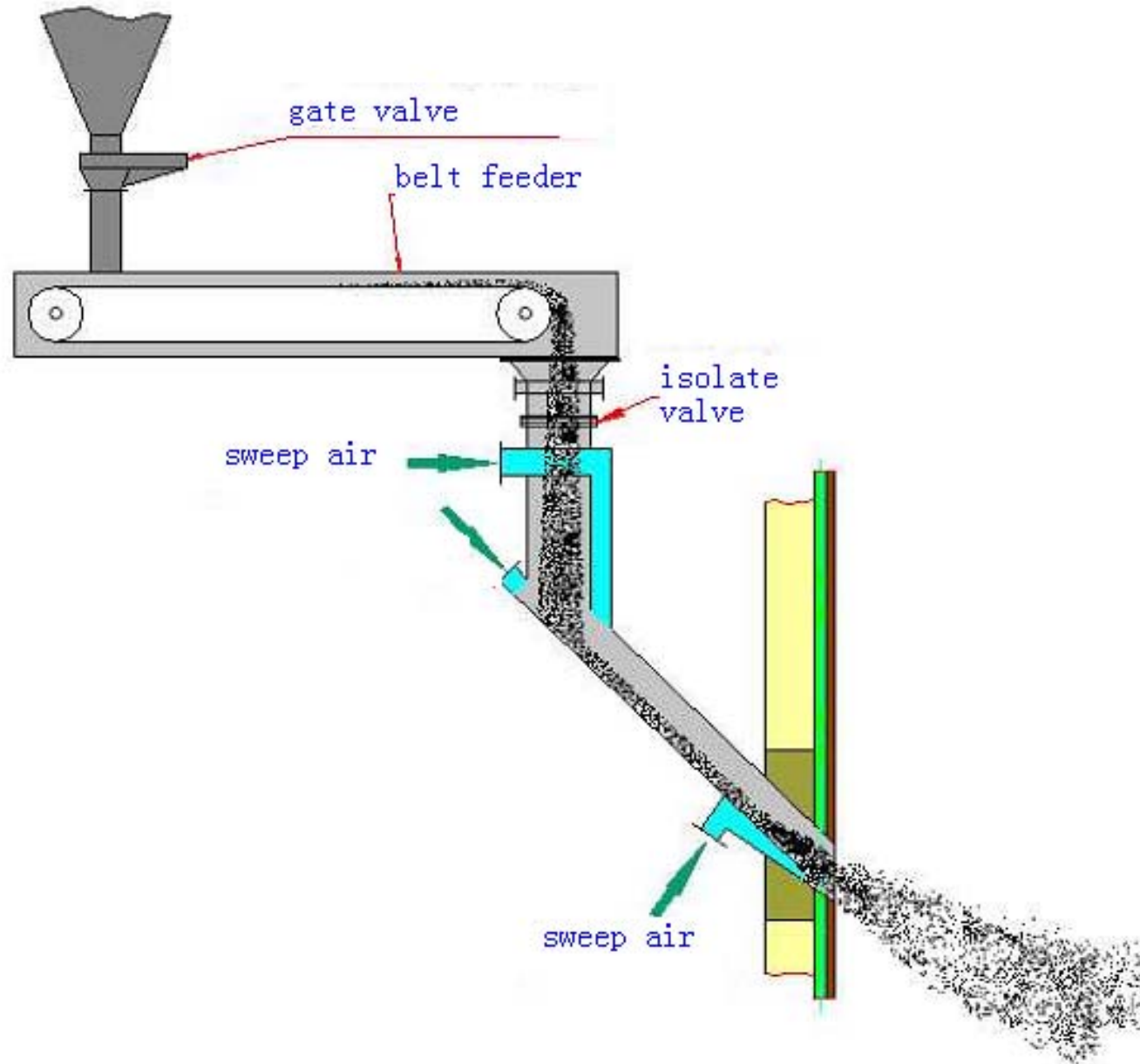


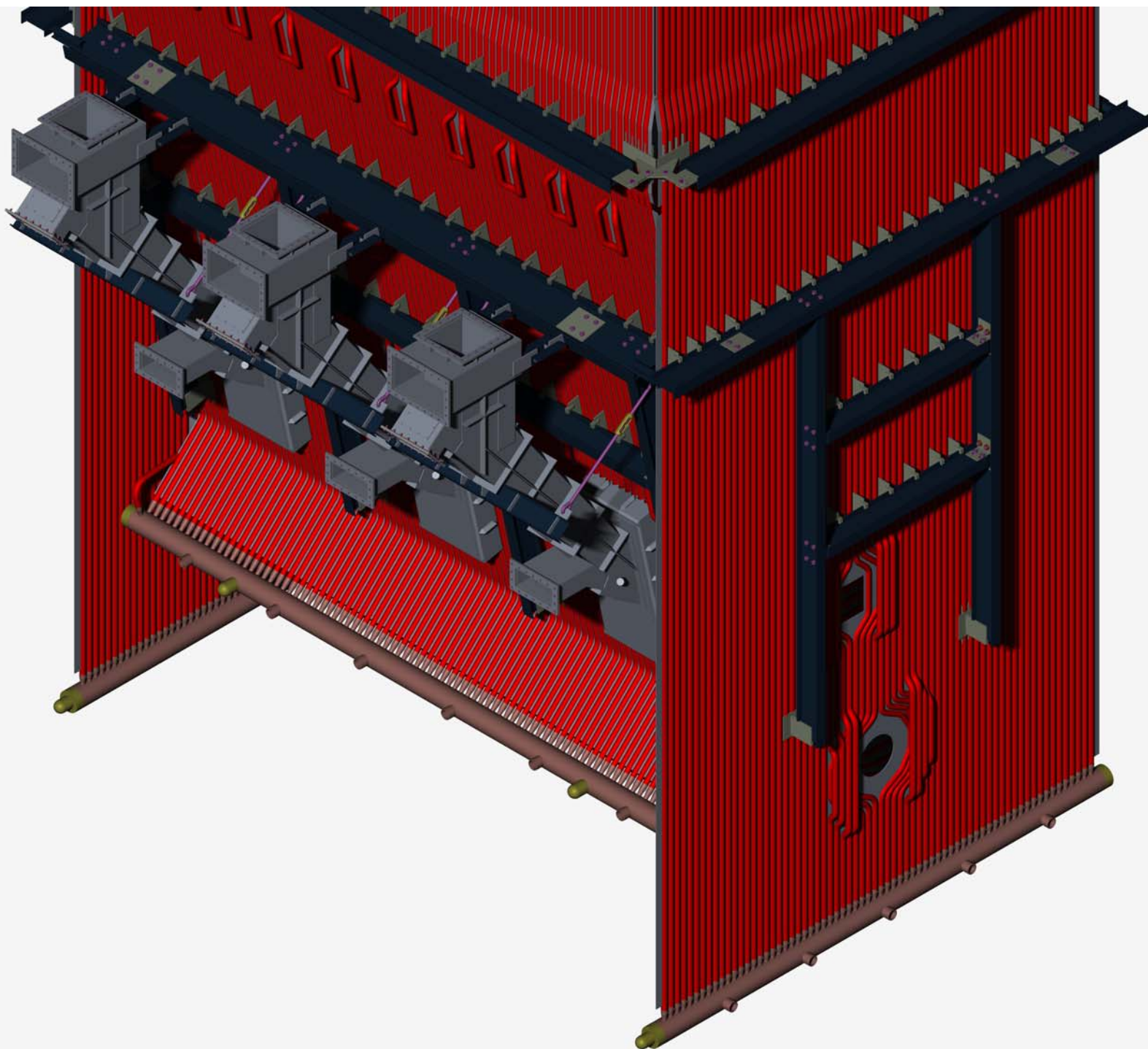
FUEL, LIMESTONE , biomass gas gun , inert material SYSTEMS

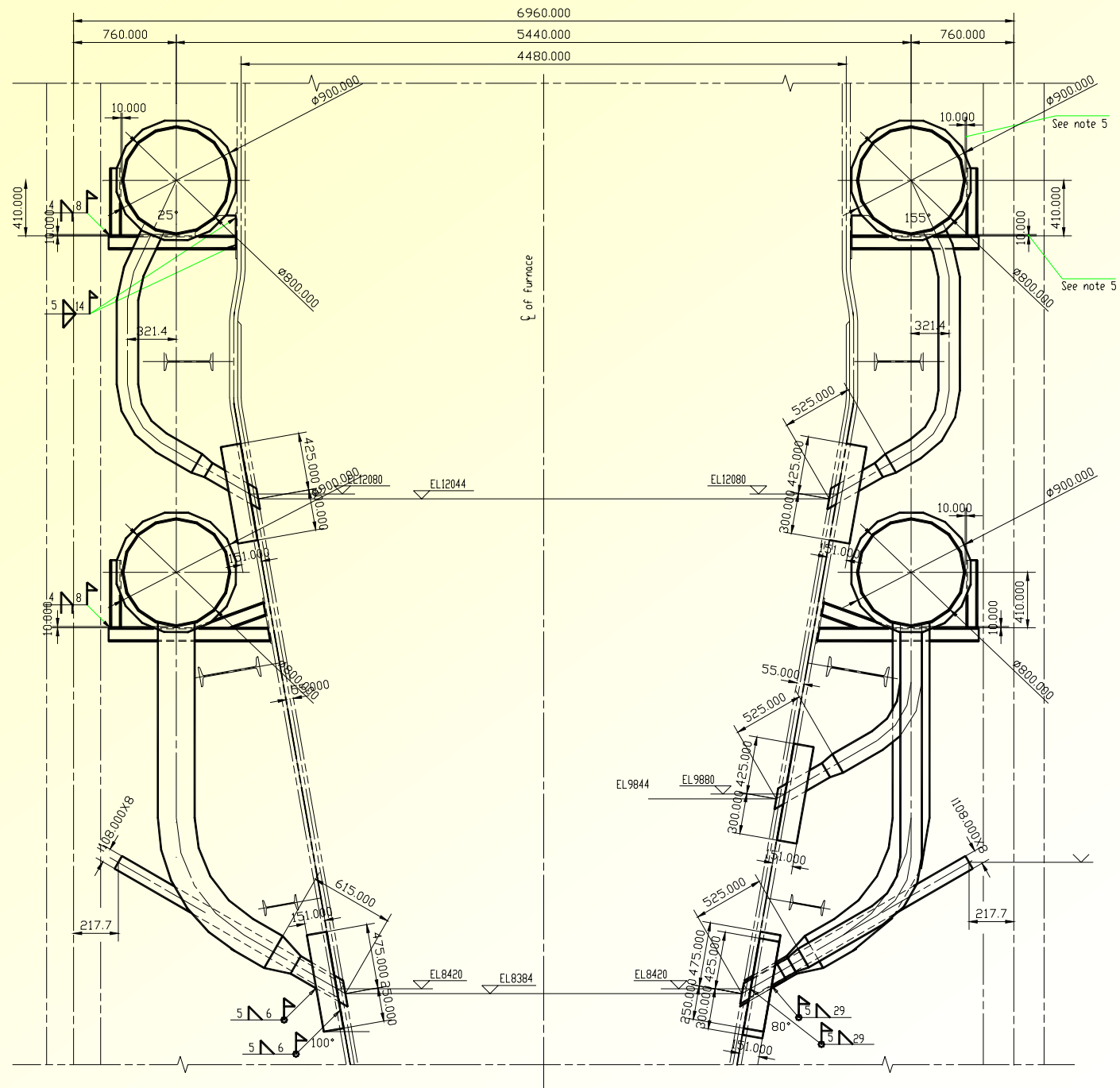


HBG CFB Design Characteristics

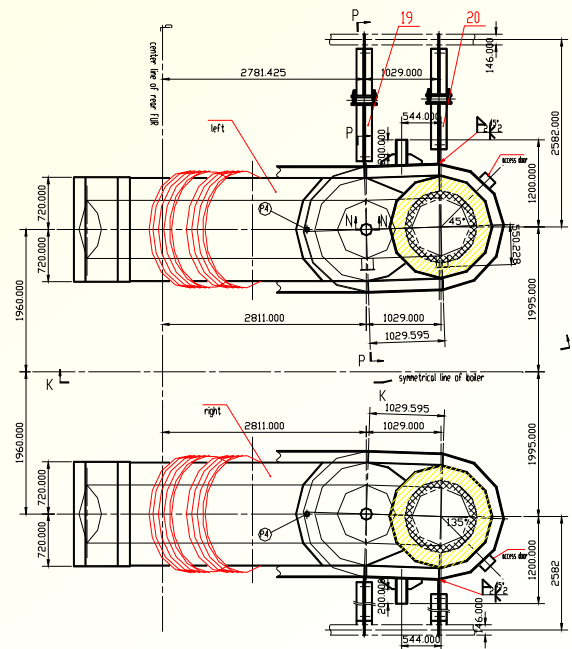
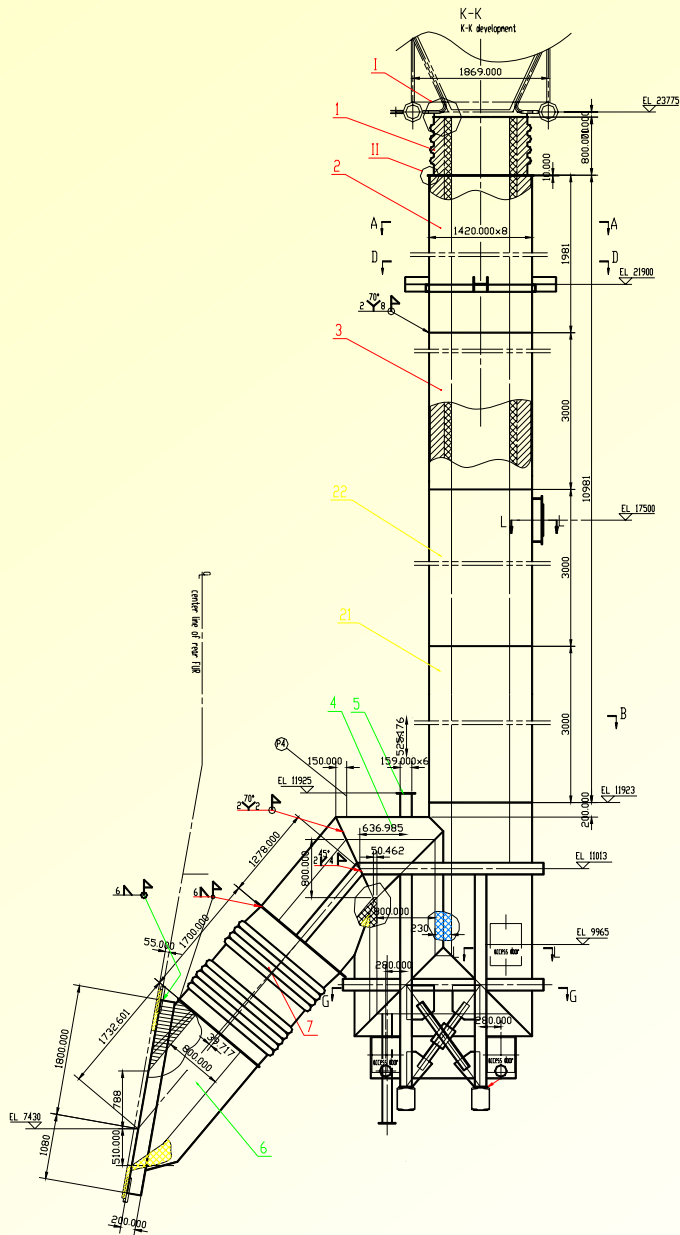
Air-driven fuel feeding device



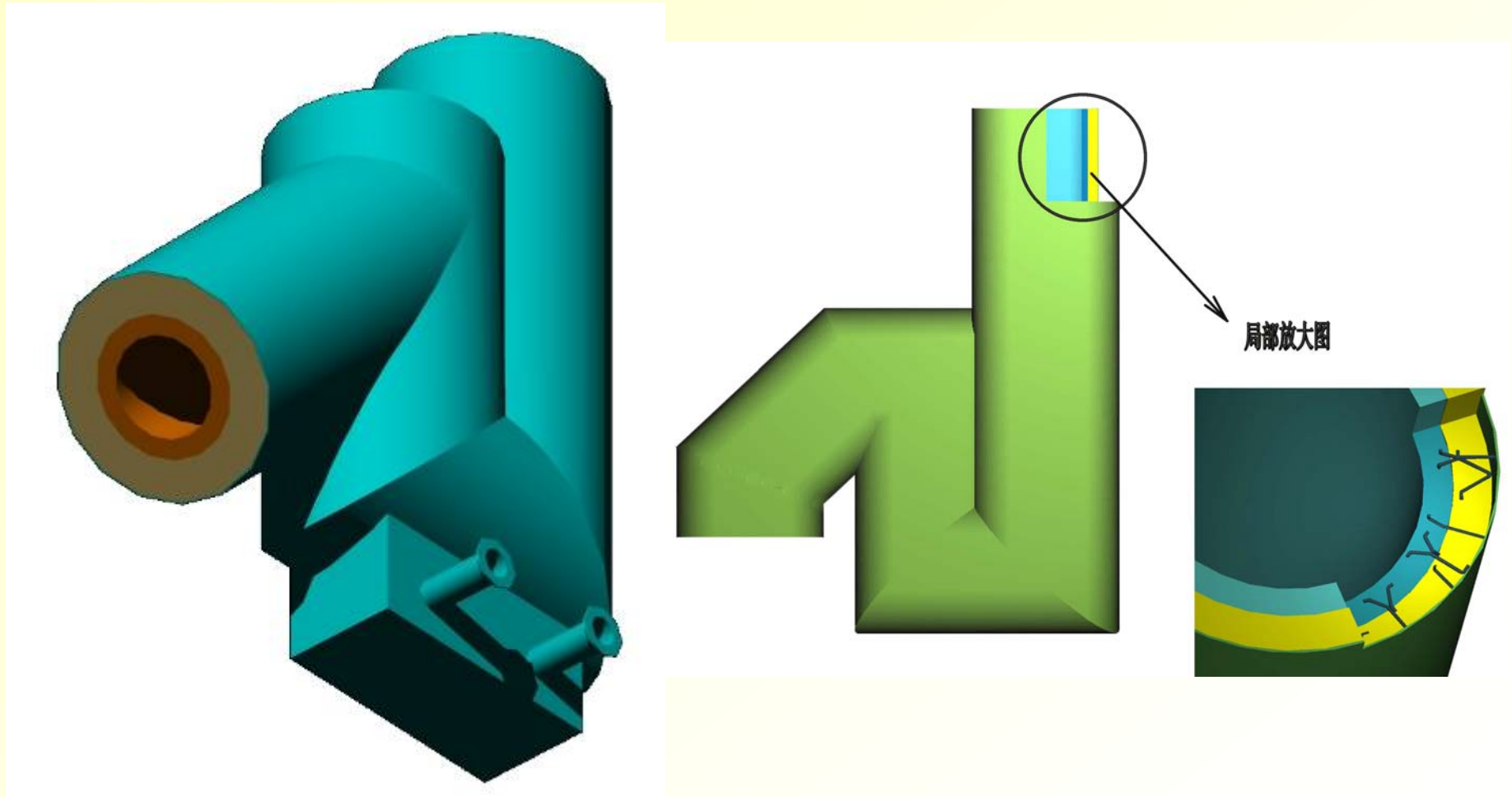




J-valve

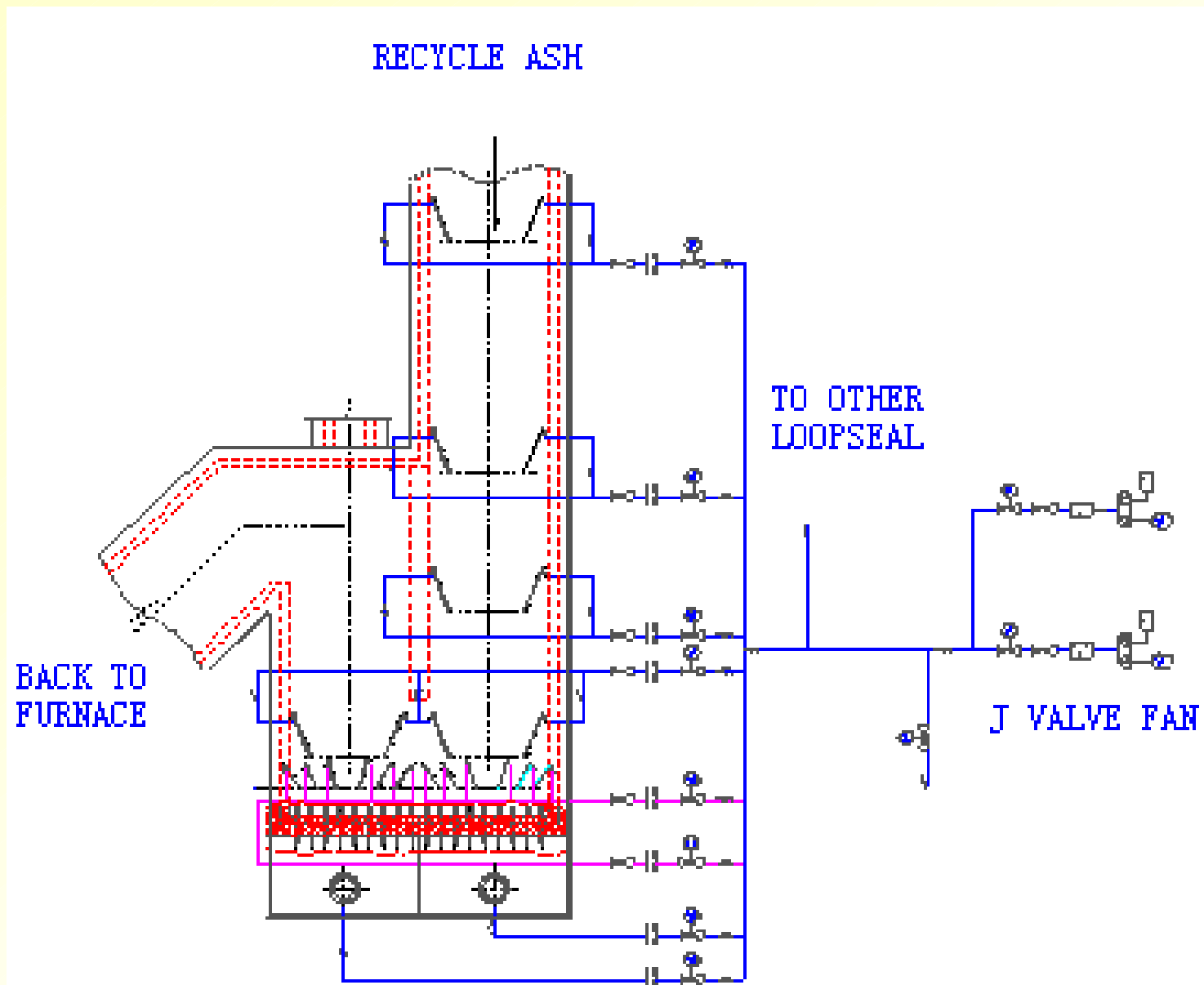


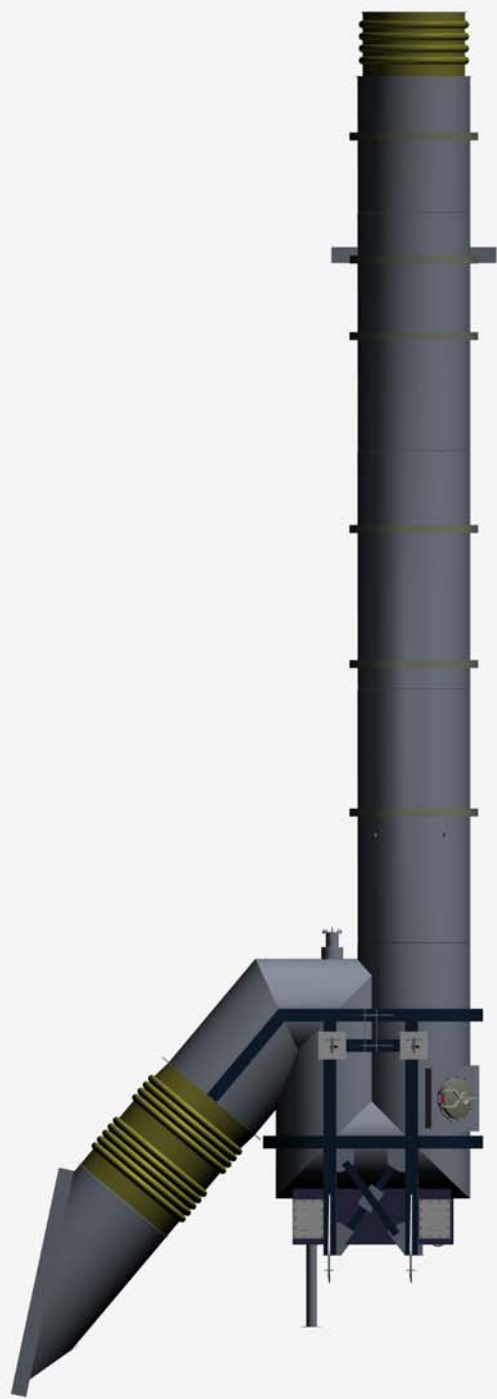
Loopseal configuration

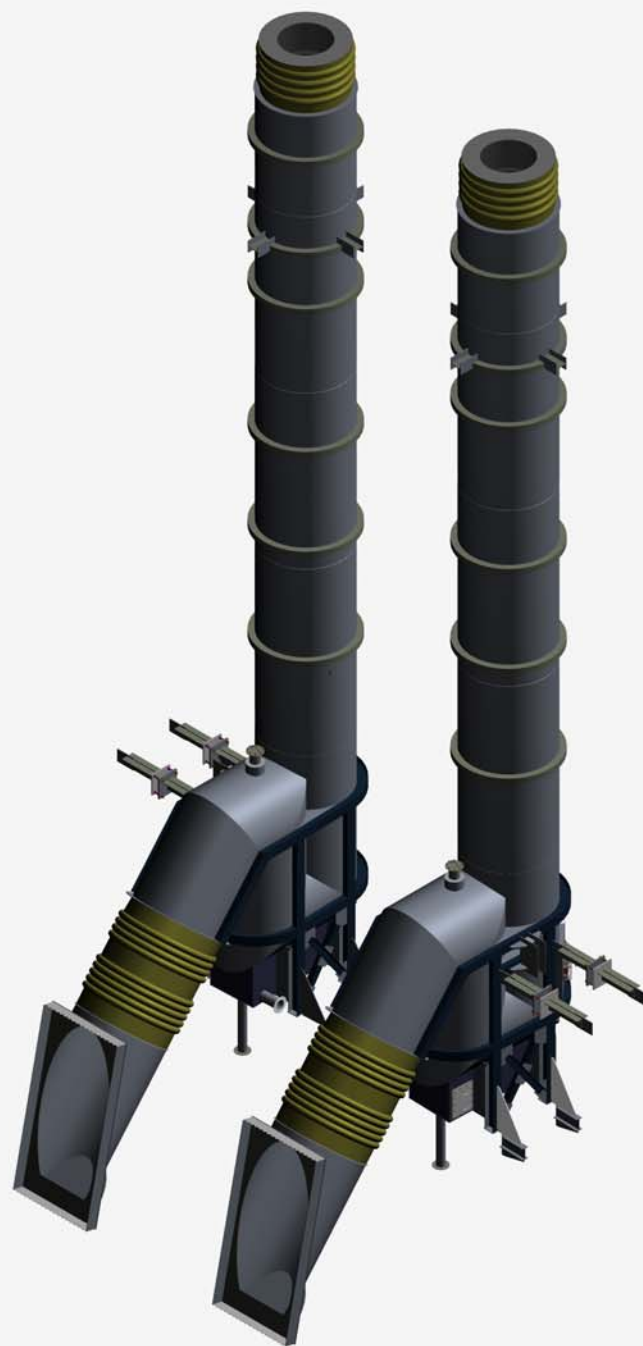


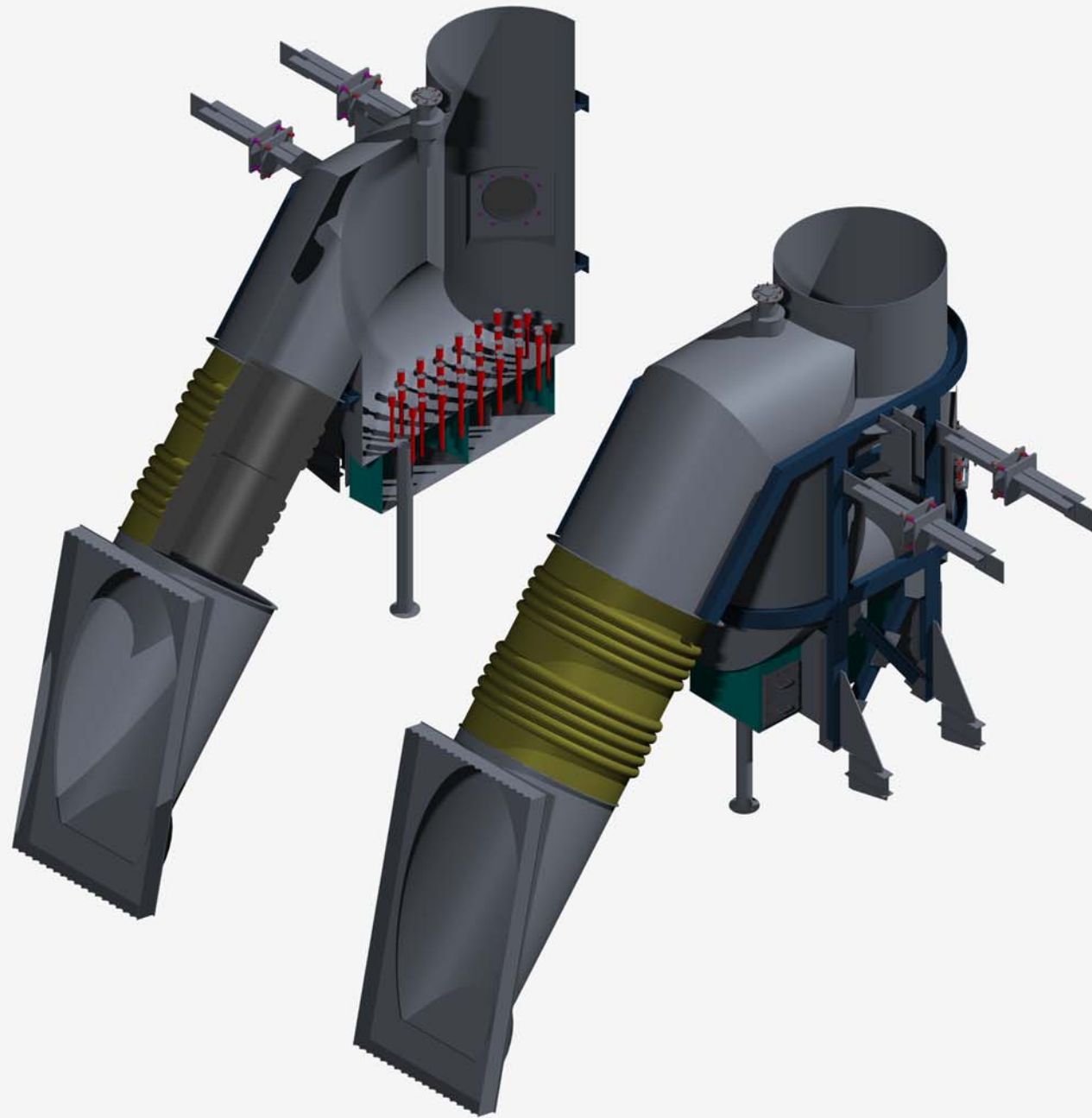
Non-cooling loopseal

Loopseal aeration

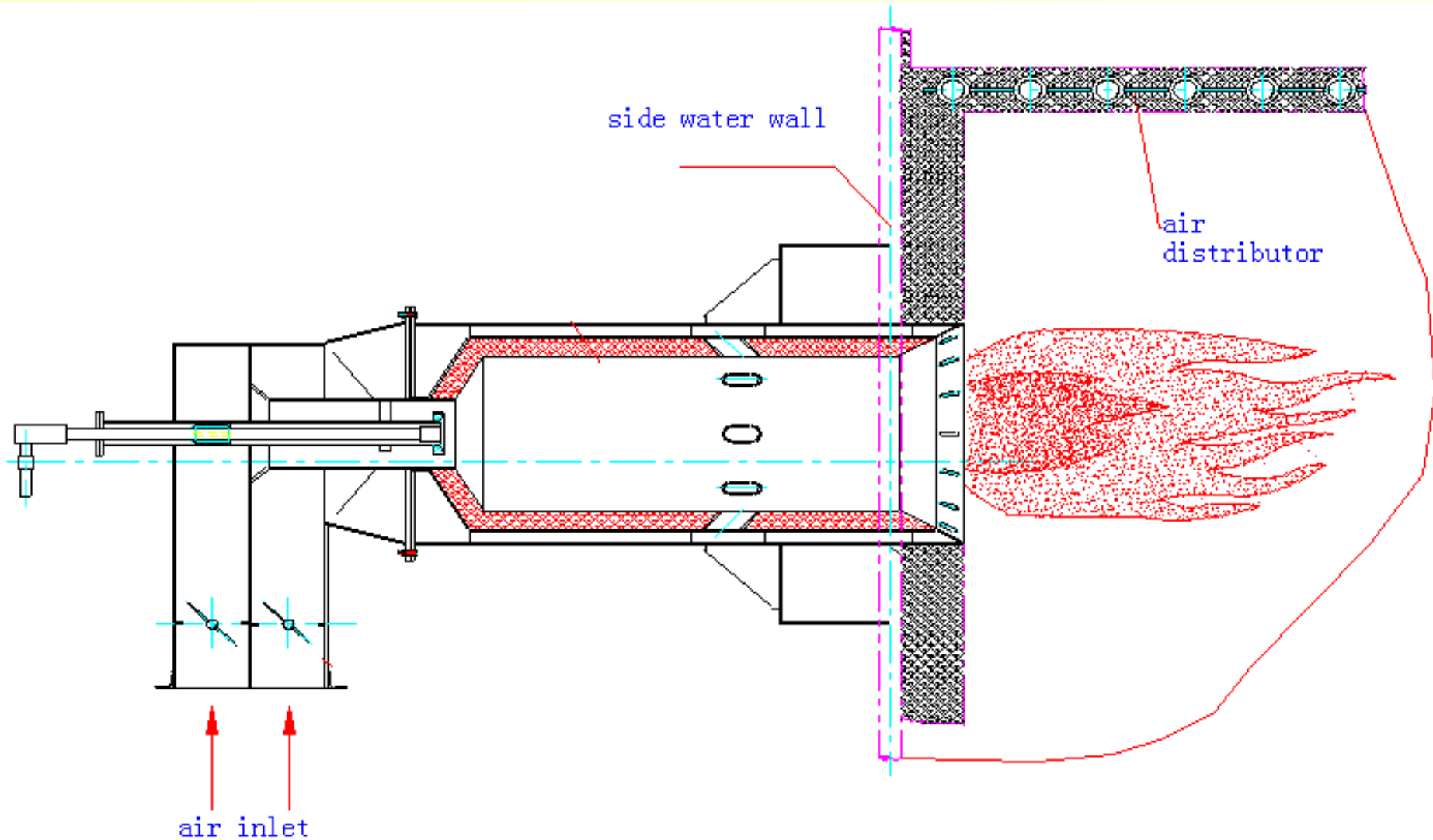






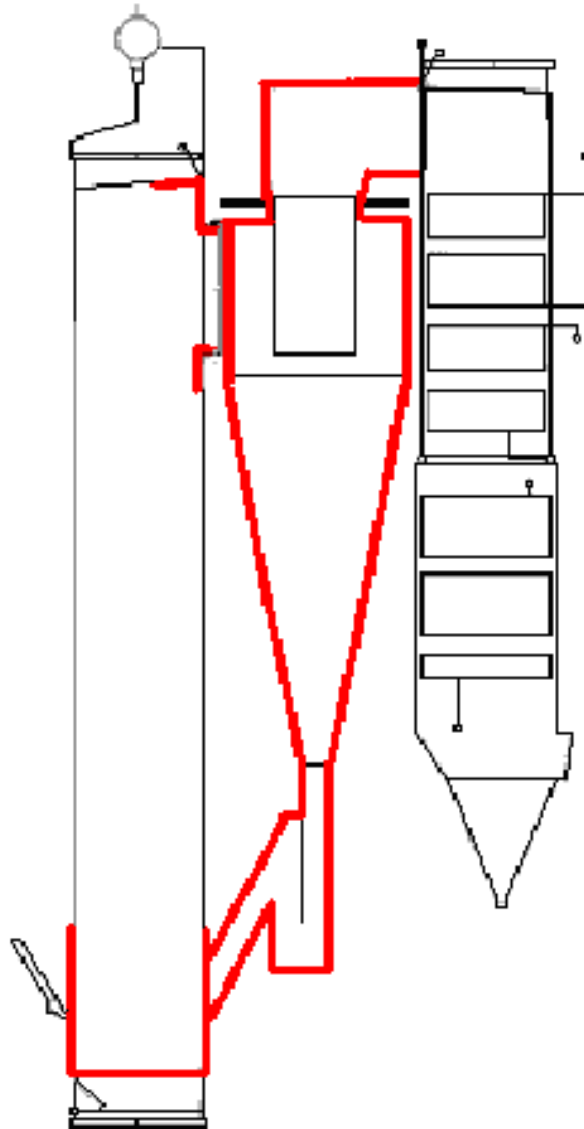


UNDER-BED BURNER

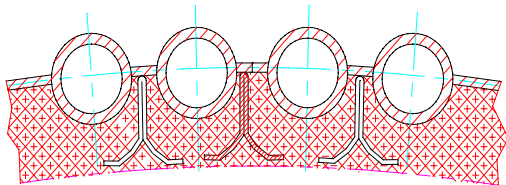
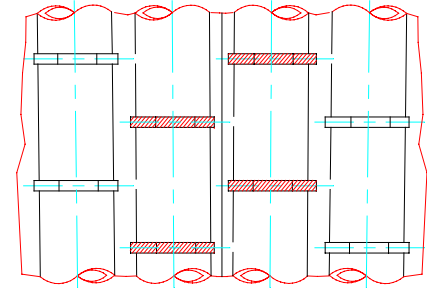
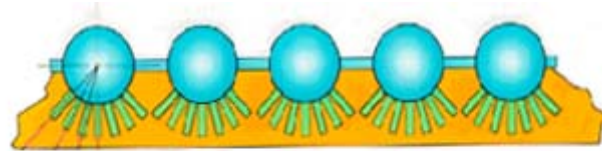
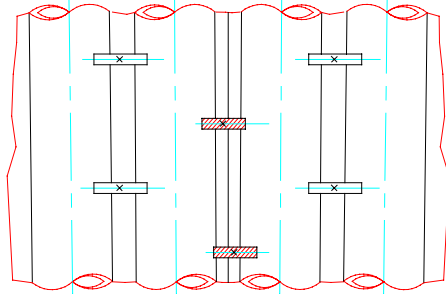
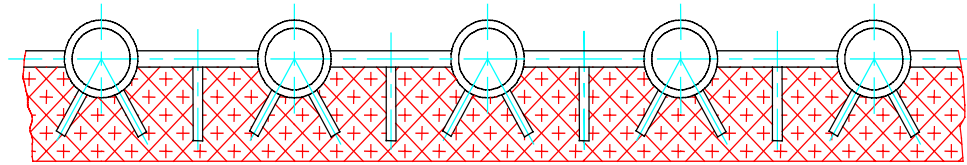


HBG CFB Design Characteristics

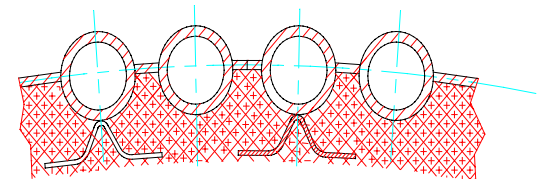
Advanced refractory system



Anchoring of refractory on site



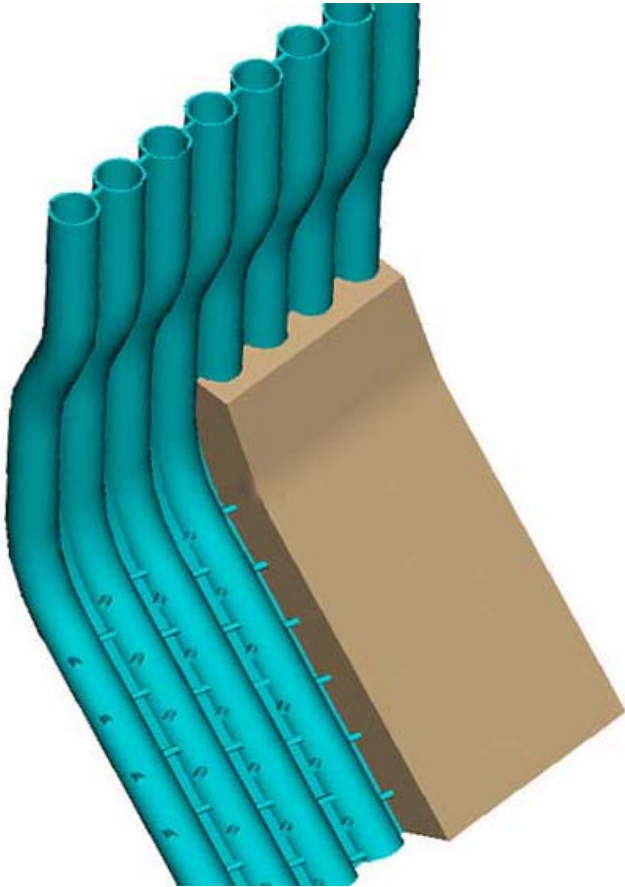
烟气侧



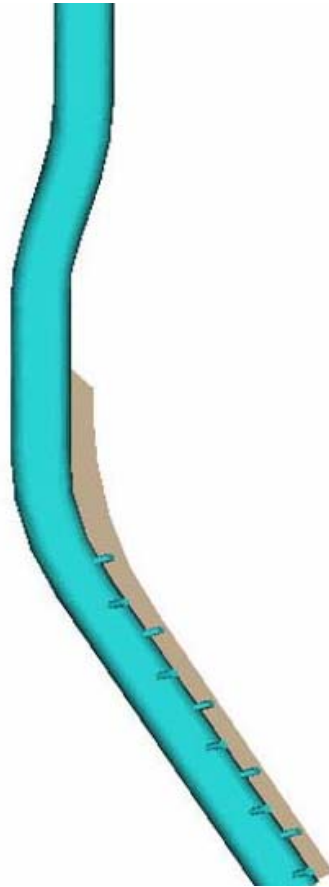
烟气侧

Membrane wall anti-erosion design

Front and rear furnace wall



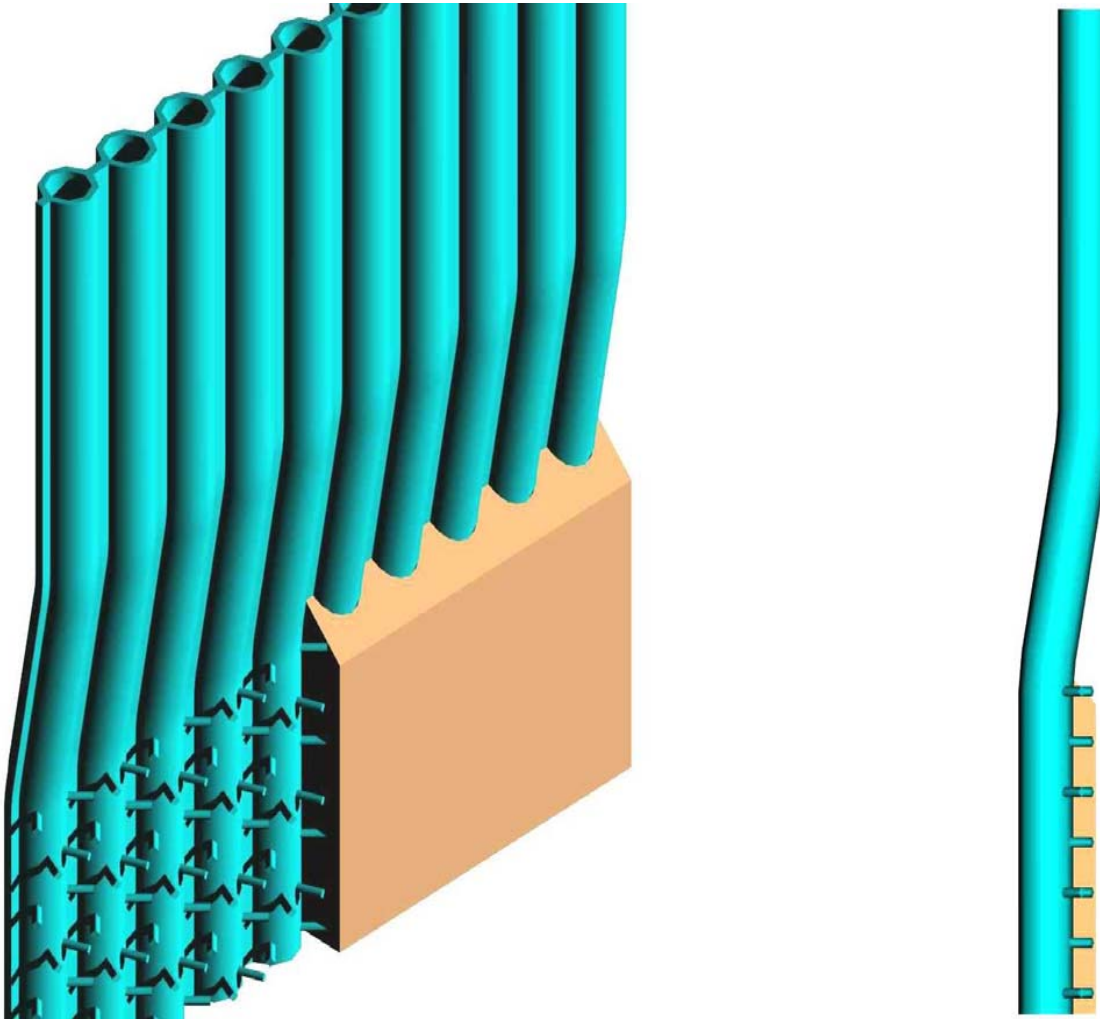
Newer configuration



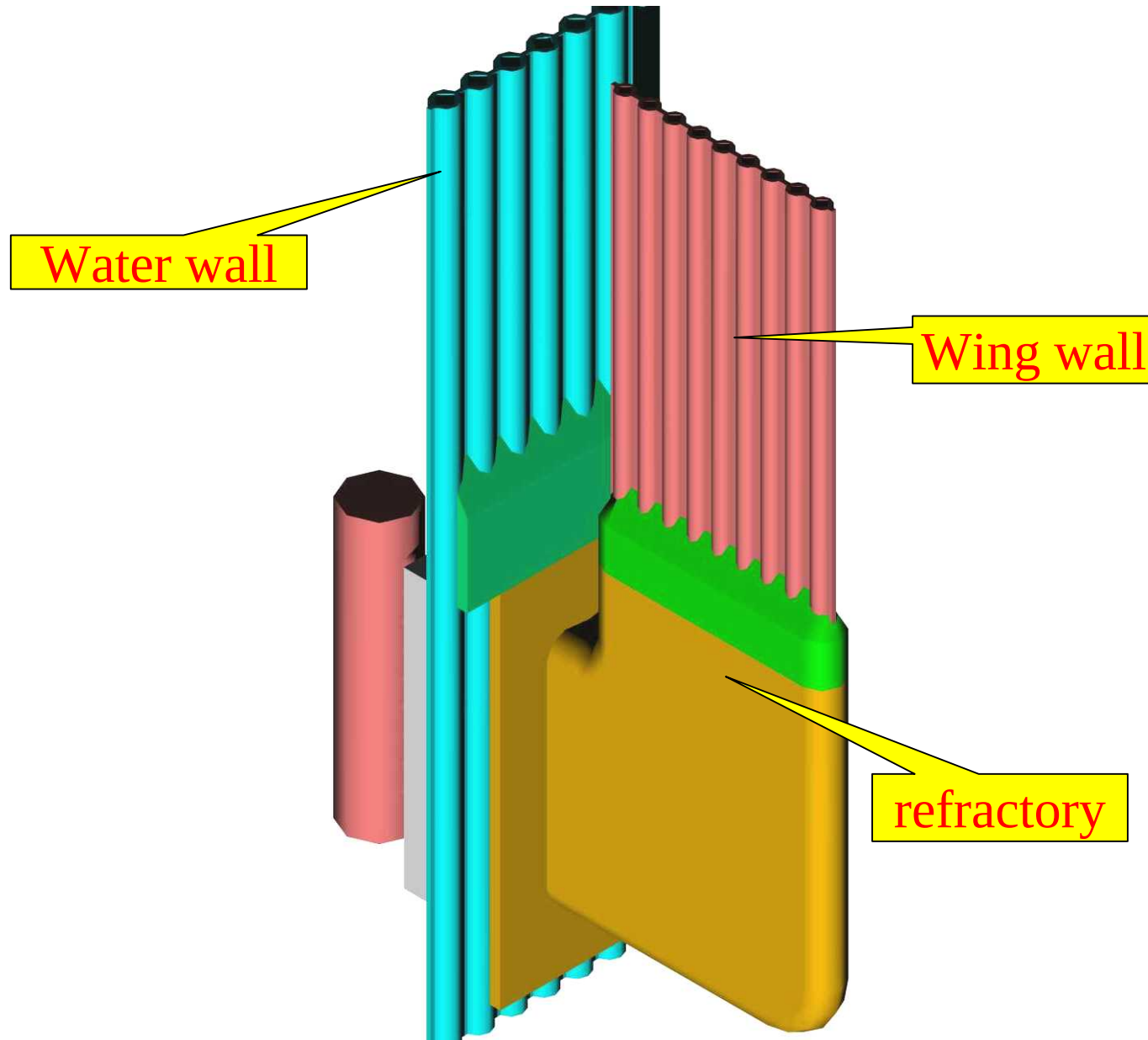
original configuration

Membrane wall anti-erosion design

Both side furnace wall



Wing wall anti-erosion design



OPERATION AND MAINTENANCE

1. GENERAL PRECAUTIONS

Furnace Pressure Limits

- normally between $-130 \sim 250$ Pa
- The Main Fuel Trip (MFT) at ± 2500 Pa with a 5 second delay
- The FD and ID fan trips at ± 3750 Pa pressure with no time delay

Main Fuel Trip (MFT)

- Fuel feeders trip
- Limestone systems trip
- under-bed burners trips
- Bottom coolers trip
- All air flow controls transfer to manual mode and hold last position
- FD fan controls transfer to manual mode and hold last position unless the cause is a fan trip. In that case, fan controls follow fan logic
- Output signal to combustion control limits ID fan automatic control from going above the furnace draft limit
- “Boiler Purge Required” logic is set unless it is a “Hot Restart” condition

Drum Water Level and Temperature Differential

- normal drum water level is 180mm below the centerline of the drum.
- The alarms set at 75mm below and 75mm above normal water level
- the trips set at 120mm below and 120mm above normal water level.
- **the metal temperature differential between top and bottom of the drum should not exceed 40°C.**

monitoring start-up conditions

Thermocouples	Location	Total Qty	Alarm Limitation Steam Temp.
Steam Drum	Top & Bottom	8	
SH Wing Wall	Outlet Tubes	1	500°C
Low Temp SH	Outlet Tubes	1	450°C
High Temp SH	Outlet Tubes	1	565°C

Excess Air Requirement

- the ECO. outlet :
an oxygen measurement of
approximately 3.1% by volume on a wet
basis.

Bed Temperature

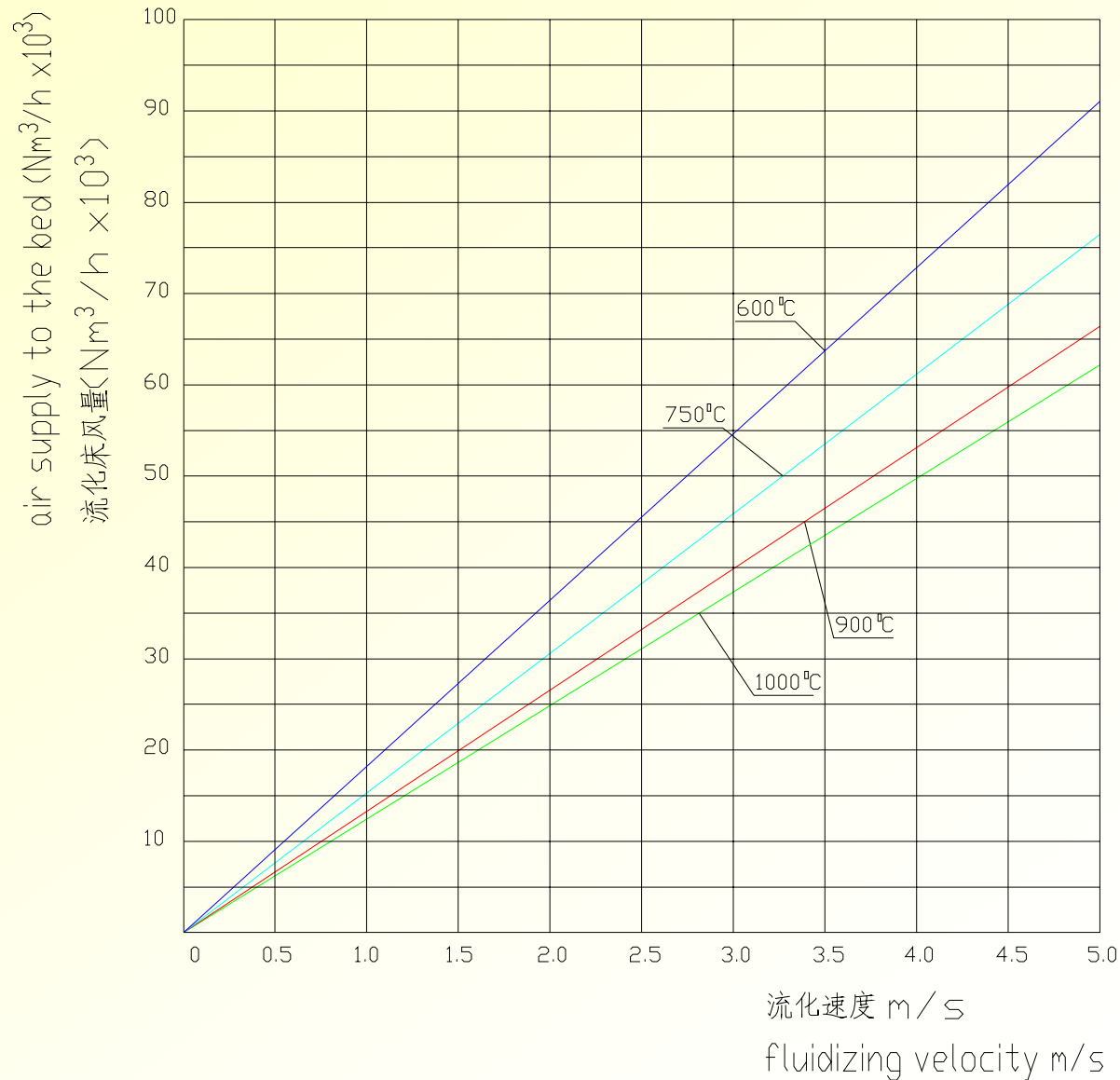
- Normal operating bed temperature is 790~920°C
- high temperature alarm point : 955°C
- main fuel trip : 990°C.
- The low bed temperature alarm : 760°C.
- main fuel trip : 650°C, unless the under-bed burner is in operation.
- fuel feeds trip off line : 540°C regardless of burner operation.

Cyclone Tube Protection

- any one of these thermocouples : 420°C , cyclone cooling steam vent opened
- The vent closes : all of the thermocouples show temperatures below 410°C .

Bottom primary air flow

- The furnace bed fluidizing velocity $> 1.2\text{m/sec}$



2.COLD START-UP PROCEDURE

- Preparation Prior to Start-up

all equipment is ready for start-up

Fill the boiler by admitting water

initial bed be charged

Check that instrument and valves , damper
work under proper condition

COLD START-UP PROCEDURE

- **Purging**

Start one J-Valve blower, the induced draft (ID), secondary fan, primary fan.

Purge air flow: at least 25% (but not greater than 40%) total air flow

Purge time: at least 5 minutes.

Purging will be accomplished and fans will be left in operation for subsequent start-up.

COLD START-UP PROCEDURE

- **Warming The Unit**

Establish combustion air flow at a minimum flow by adjusting FD fan inlet vanes.

Check that between economizer inlet and downcomer recirculation shut-off valves are open.

light-off the under-bed burner

Heat the bed material and raise the drum pressure.

Raise the bed temperature to 450°C

COLD START-UP PROCEDURE

- Start-up (Fuel Firing)

Start three coal feeders : batch feeding coal into furnace increasing average bed temperature (ABT) to 760°C.

Shut off oil gun, the feeder can be left in operation.

Boiler load can then be increased by increasing feeder capacity.

the steam flow is greater than 7%, close the economizer to downcomer recirculating shut-off valves.

Adjust combustion air flow and fuel flow to establish bed temperature of 900°C maintain O₂ at 3.1%

At this time begin operating the bottom ash coolers continually as cooler instruction.

HOT RESTART

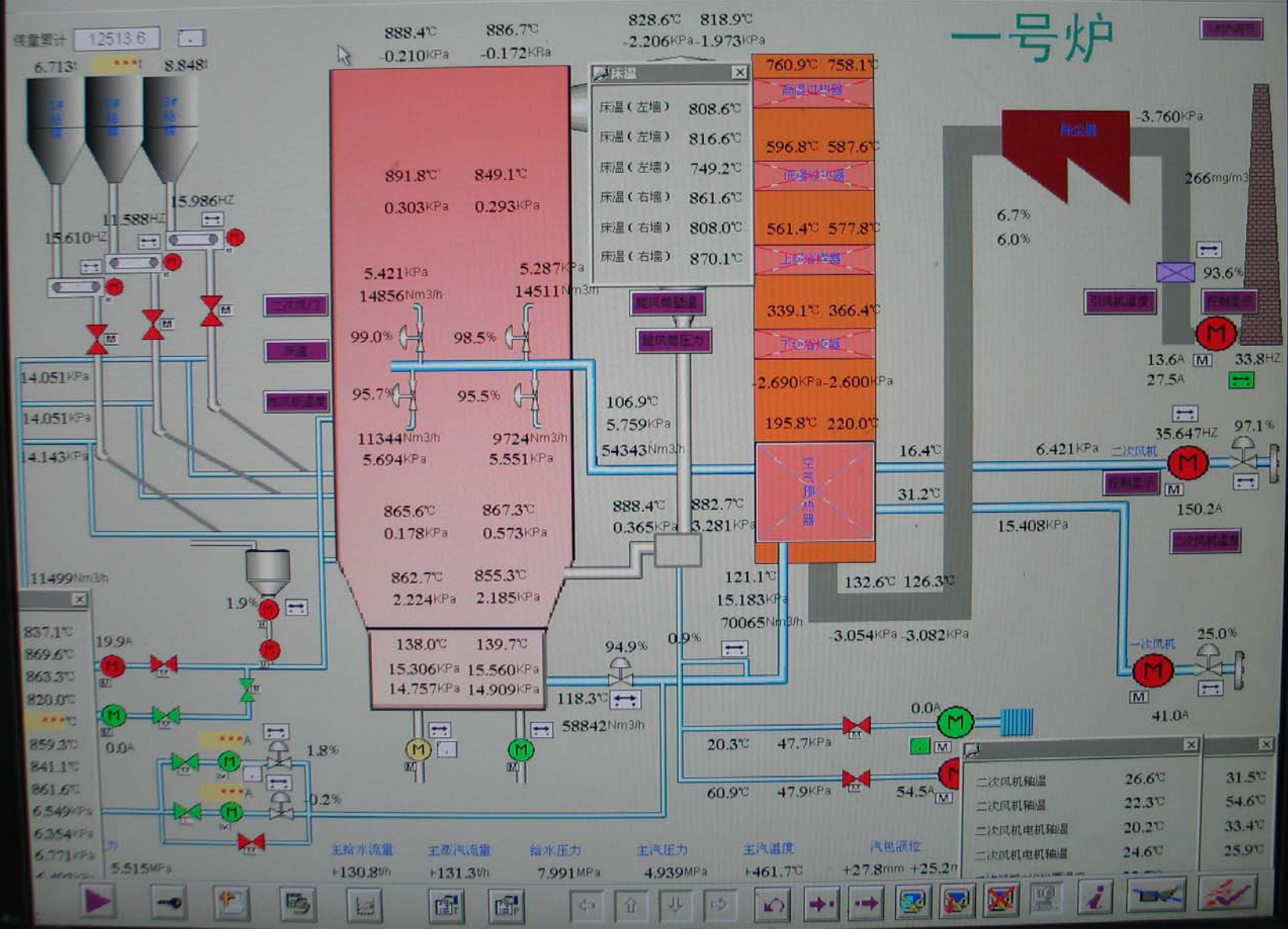
- fuel feed should be stopped
- the FD and ID blowers, The J-valve blower should remain in operation until cooling to below 260°C.
- air and flue dampers be closed
- **hot restart condition: the average bed temperature is above 650°C.**
- Start one (1) J-valve blowers, ID fan and FD fan and following cold start up procedure
- **When re-establishing air flows in a hot start condition, bed temperatures may drop rapidly. Establish overfire air (secondary air) first and then grid air to minimize heat loss.**
- if bed temperature does not rise within five minutes of the fuel feed, ignition has not occurred. The feed must be stopped, the unit purged and the unit started following the normal cold start-up procedur

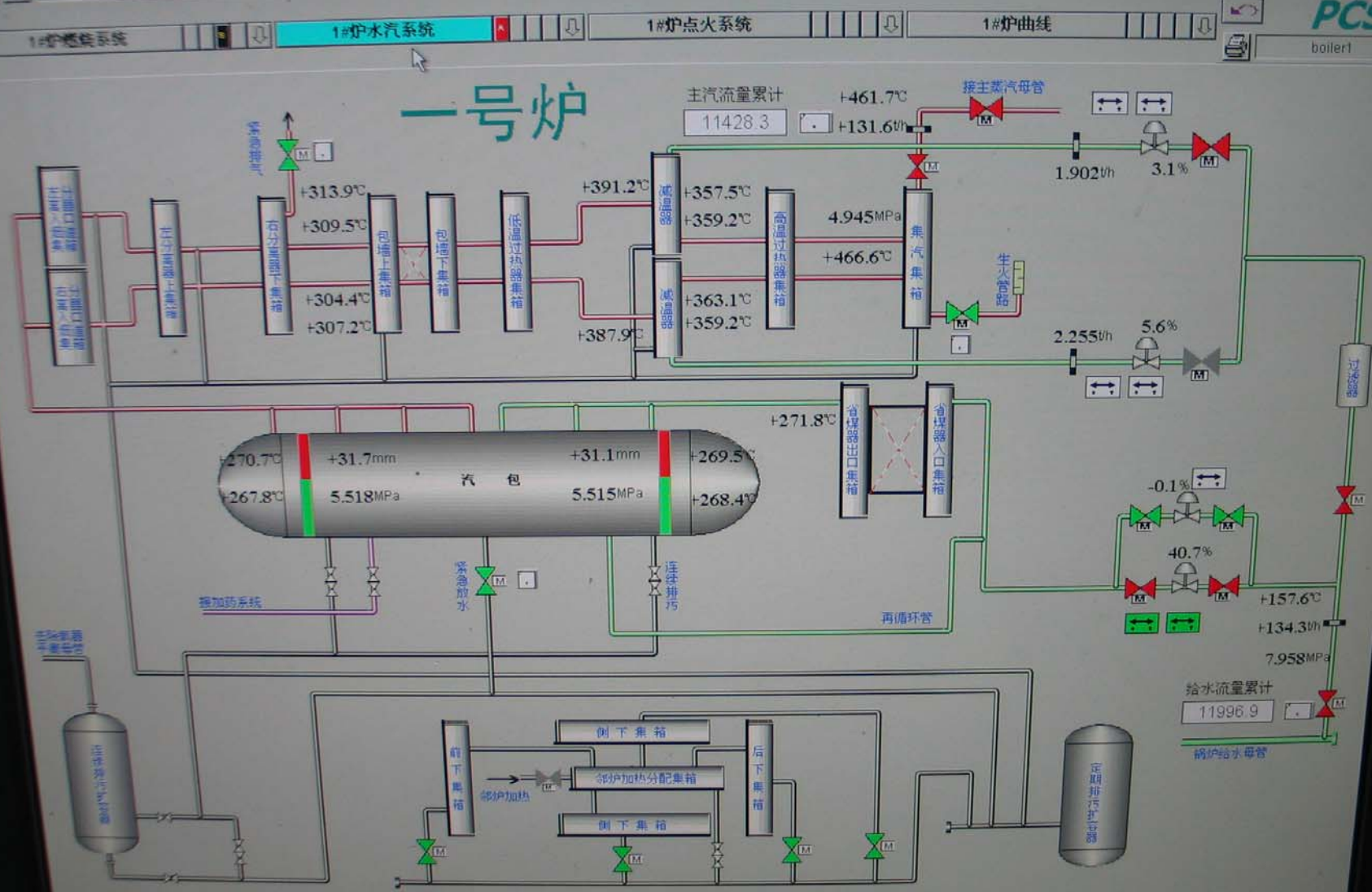
NORMAL OPERATION

- Bed temperature
- The SO₂ emissions
- the fluidized beds for even fluidization
- the fluidized bed level
- Water Chemistry and Steam Purity
- SootBlowing

NORMAL SHUTDOWN

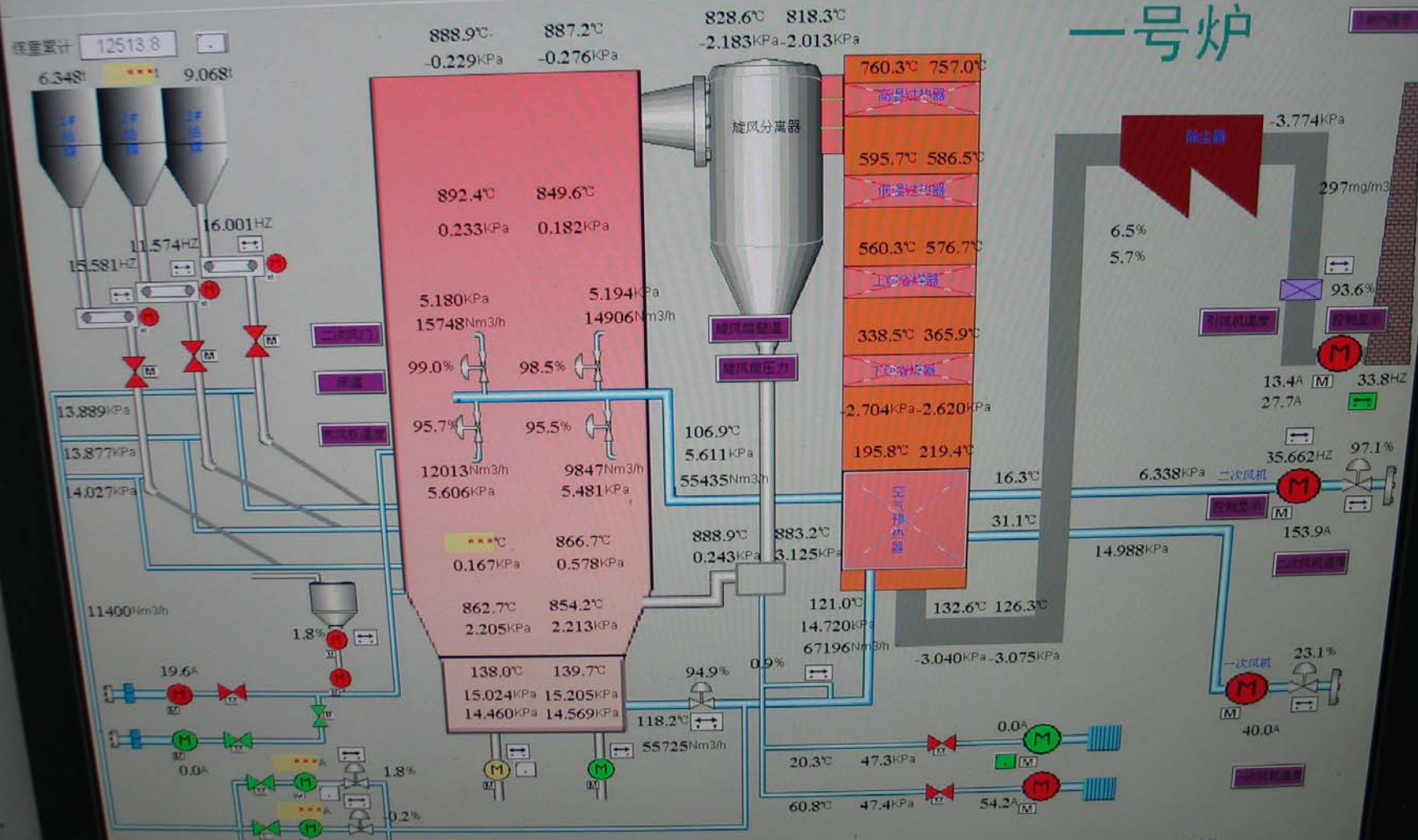
- Sootblowing before reducing load and taking unit out of service
- maximum temperature difference of 40°C between top and bottom of the drum.
- Maintain minimum unit load for approximately 30 minutes
- close all fuel silo hopper outlet shut-off valves and empty all fuel off the feeders.
- Stop limestone feeder systems.
- Monitor boiler oxygen levels and bed temperatures. After all fires have been extinguished, leave the FD and ID fans in operation for at least five minutes to purge boiler.
- continue to cool down the unit using the fans, while removing bed material via the bottom ash cooler
- the fans be taken out of service
- The J-valve blower should remain in operation until cooling to below 260°C.
- Stop other system





1#炉燃烧系统 1#炉水汽系统 1#炉点火系统 1#炉曲线

一号炉



汽包压力 5.518MPa 5.515MPa 主给水流量 135.0t/h 主蒸汽流量 131.4t/h 炉水压力 7.963MPa 主汽压力 4.945MPa 主汽温度 462.8°C 汽包液位 +30.1mm +24.7mm

HBG CFB BOILER PICTURE



