Our activities also include :

- Sugar Plant & Machinery
- Open Cast Mining & Bulk Material Handling Systems
- Cement Plant & Machinery

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Circulating Fluidised Bed Combustion (CFBC) Boilers

Powerful solutions for steam generation

ISO 9001 REGISTERED
MGMT. SYS.
RvA C024
DNV Certification B.V.,The Netherlands

A Company of ThyssenKrupp Technologies

ThyssenKrupp Industries India

ThyssenKrupp

Steam Generators with Circulating Fluidised Bed Combustion (CFBC) Technology

1. Boiler drum
2. Airbox
3. Boiler under erection

ThyssenKrupp Industries India offers a wide range of world-class Circulating Fluidised Bed Combustion Boilers. A modern concept in steam generators, these state-of-the-art systems are designed and manufactured for a wide range up to about 500 TPH.

These boilers have multi-fuel firing capacity, high thermal efficiency, low emissions of SOx & NOx and can effectively utilise high ash coals, lignites, washery rejects, petcoke, etc.

The system

The fuel and the cold fly ash recirculated to the fluidised bed is well mixed with the hot bed material resulting in a uniform temperature distribution in the bed. This is achieved by a higher turbulence caused by introducing fluidising air in smaller bed dimensions.

Unlike the Bubbling AFBC boilers the erosion prone submerged heating surfaces are dispensed with. The recirculated cold fly ash takes over the cooling of the fluidised bed. It is in the convection pass that the heat taken is transferred to the convectional heating surfaces. The boiler has a tower-type arrangement.

The first boiler pass is formed by water-cooled, gas-tight membrane tube walls. They are part of the evaporator system and are designed for natural circulation.

The lower section of the first boiler pass consists of the combustion chamber with the fluidised bed and the freeboard above. The upper section is made up of a convection heating surfaces namely superheater, evaporator and part economiser. This first boiler pass is top supported allowing easy expansion downwards.

The second boiler pass has remaining part of the economiser heating surface and the tubular airheater.

The elutriated fly ash is separated from the flue gases in cyclone separators located between the boiler first and second pass, at a temperature of around 400°C. It is recirculated into the combustion chamber via a siphon system which serves as a seal.

The heated combustion air from airheater is passed through the air nozzles into the fluidised bed as primary air, and above the fluidised bed into the freeboard as secondary/tertiary air.

Combustion takes place within an optimum temperature of 800°C to 950°C.

The flue gases are conducted to the chimney via an ESP and induced draught fan.

The preparation of fuel is relatively simple. The fuel is crushed to a size of apprx. 8 mm. No grinding of coal is necessary. The fuel is fed into the fluidised bed together with recirculated fly ash.

Limestone can be added to the fuel to capture sulphur, if required, to meet stringent SOx emission values.

The ash from the fluidiesd bed, the cyclone and the ESP is conveyed pneumatically to the main ash silo, keeping the plant clean of ash.

The boiler is designed with fluidising velocities up to 4.5m/s, generating a high turbulence and resulting in a good mixing of hot bed material with fuel and recirculated fly ash.

The height of the bed is kept constant by removal of the produced bed ash as a function of the differential pressure between the airbox and freeboard.

In the freeboard (the upper part of the combustion chamber) the fine fuel particles with a size below 0.4 mm that have been elutriated from the fluidised bed and part of the volatile matter are burnt.

This post-combustion releases approx. 40% of the total combustion heat and then is transferred to the flue gas or, by way of radiation to the cooled combustion chamber walls.

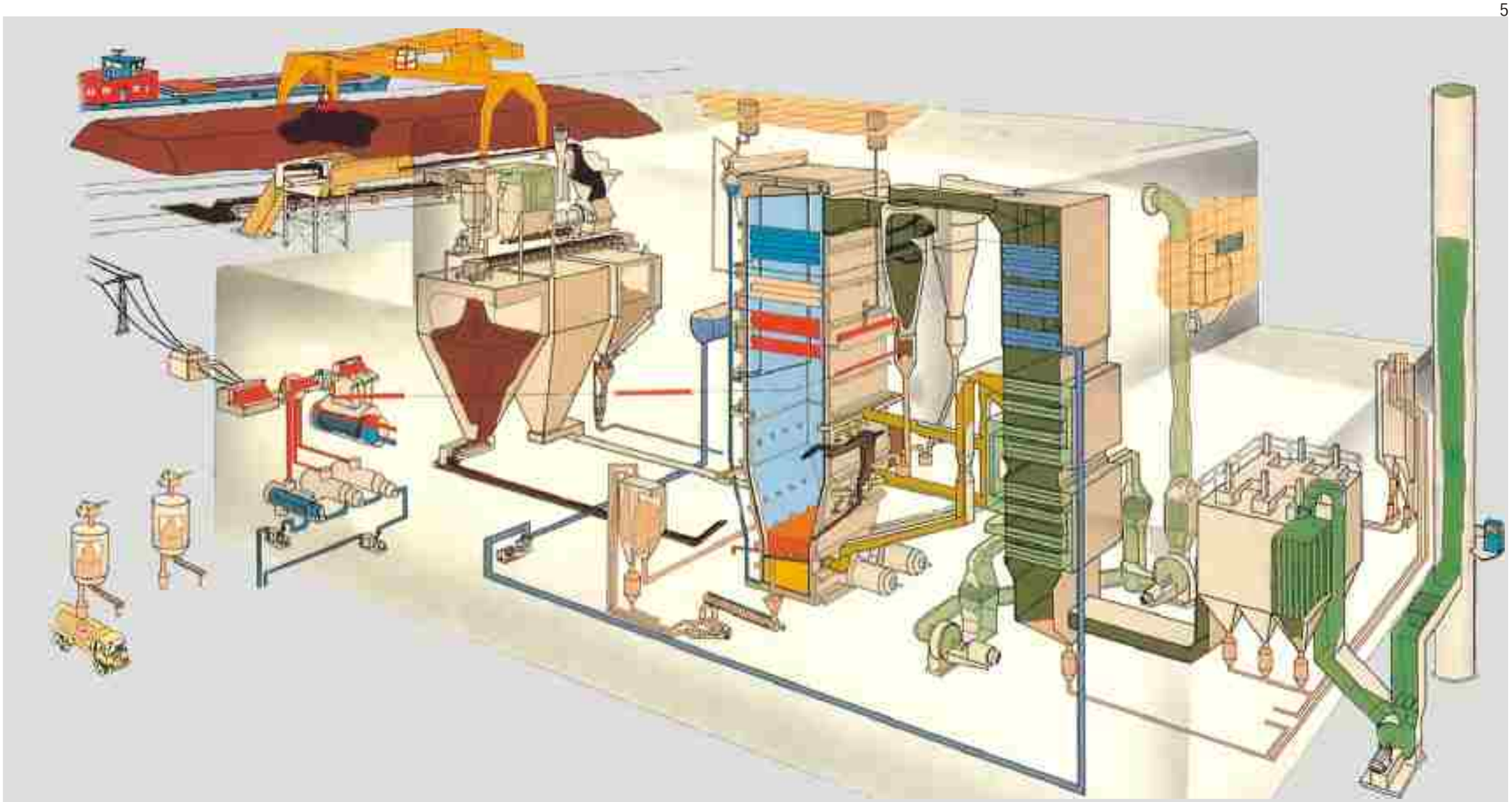
The amply dimensioned freeboard height guarantees a mean residence time of flue gases of at least 4 seconds. The correspondingly long residence time of elutriated fuel particles has its decisive share in the high degree of combustion and desulphurization efficiency.

The recirculated fly ash quantity is adjusted to maintain a temperature of the fluidised bed of about 850°C.

This quantity of fly ash recirculation suffices to ensure the burn-out of fines and the capture of sulphur in the freeboard at optimal consumption of limestone.

Superior features of CFBC boiler - cold cyclone design

1.	High efficiency (even at part loads) - low operating cost.
2.	Wide fuel band - can burn coal, lignite, washery rejects, pet coke etc.
3.	Simple fuel preparation - no grinding required
4.	Low emission levels - due to staged combustion
5.	Quick start up - due to cold cyclone design
6.	Good load chasing ability - comparable to PF boilers
7.	Low erosion risk - no bed tubes
8.	Reduced maintenance - minimum refractory



Advantages of Cold Cyclone CFBC Boiler over Bubbling Bed Boiler

	Particulars	Bubbling Bed	CFBC (Cold Cyclone)	Advantage for CFBC (Cold Cyclone)
1.	Economic range	<60 TPH	60-500TPH	Lesser floor space requirement
	Type	2-pass	Tower	
2.	Thermal Eff. (Coal)	83%	87%	Better efficiency due to ash recirculation and longer reaction time in large furnace.
	Carbon burn up	93%	98%	
	Power consumption	~ 14 KW/MW (th)	~ 18 KW/MW (th)	Higher bed height of 1600mm vs. 1300mm.
	Fuel flexibility	Limited range	Wide range	Staged air, larger furnace volume, more residence time
	Fuel preparation	<8 mm	<8 mm	
	Fuel fines <1mm	<20%	<50%	No monsoon problems of feeder jamming & coal pipes jamming
	Fuel Moisture	~10-12%	~16%	
3.	Reliability	Low	Very High	No inbed tubes, No erosion problems
	Response	Poor	Very good	Equal to PF
	Auto Controls	Combustion control not possible	Possible	Stepless turndown upto 30% achievable.
4.	Fluidising velocity	2-3 m/sec	4-5 m/sec	Leads to more compact furnace.
	Furnace Resi. Time	2-3 sec.	4-5 sec.	
	Bed heat release	~1.5 MW/m^2	~5.0 MW/m^2	
5.	Bed Temp.	Falls at part loads	Constant	Much better part load efficiency
	Bed Temp. Control	In-bed tubes & bed partition	Ash recirc & staged combustion	Auto combustion control possible.
	Bed level control	Intermittent draining	Intermittent draining	No bed tube erosion
6.	Emission (mg/Nm^3)			
	-NOx	<600	<200	Due to larger furnace & staged combustion
	-SO_2	~300	~300	Due to ash & Limestone recirculation
	Limestone requirement	More	Less	
	Desulferisation Limit	85%	95%	
	Meets pollution Norm	No	Yes	
7.	Quick & +ve start-up	No	Yes	Start-up using Hot Gas Generator
8.	Ease of Operation	Less	More	Simpler systems, auto controls

Advantages of Cold Cyclone CFBC Boiler over Pulverised Fuel Boiler

	Particulars	Pulverised Fuel	CFBC (Cold Cyclone)	Advantage of CFBC (Cold Cyclone)
1	Thermal Efficiency	~87%	~87%	Practically Same
2.	Power consumption	Higher due to grinding	Lower than PF	No milling equipment
3.	Oil Firing	Start up & upto 50% load	Only start up	Big savings in oil as no oil required for part lod operation
4.	Fuel preparation	<75 micron	<8 mm	No grinding of fuel. Less power.
	- Fuel Flexibility	Limited	Wide range	Very poor fuels can be burnt like lignite & washery rejects
	- Max. Ash + H_2O	~62%	~ 75%	
	- Abrasive coals	High Mill Wear & maintenance	None	Adequate precaution taken for pressure part
	- High sulphur fuels	FGD Plant reqd.	$CaCO_3$ dosing	In situ SO_2 capture
5.	Emission (mg/Nm^3)			
	- NOx	~ 650	<200	Low NOx due to low combustion temp. of about ~850°C
	- SO_2	~ 2600	~300	Meet pollution low of future also
6.	Start up time	~ 5 hrs. with multiple burner	3-4 hrs with 2 Hot Gas Gen.	Big saving in oil bill & over all plant operation cost
7.	- Moving Equipment	Feeders, Mills	Only feeders	No mills
	- Maintenance	High	Low	Maintenance friendly
8.	Pressure Part			
	- Arrangement	2 Pass type	Tower type	Lesser floor space requirement.
	- Erosion	Moderate	Less	No gas turns on tube banks so less wear
9.	Soot Blowers	Many & all over	None	No steam consumption or maintenance
10.	Space	More	Less	Compact layout
11.	Ash Handling	Wet & Dry	Dry	System very simple, clean & automatic
12.	Explosion Risk	High	None	Safe & reliable operation
13.	Boiler Control	Complicated	Very Simple	
14.	Burner Controls	Complicated	Very Simple	Only 2 Hot Gas Generators

Blue chip references

Client & location	No. of Boilers	Capacity (TPH)	Pressure (Bar)	Temp. (°C)	Fuel	Application
Tata Chemicals Ltd. Mithapur, Gujarat	1	200	112	565	Lignite	Cogeneration
Nava Bharat Ferro Alloys Paloncha, Andhra Pradesh	2	151	91	530	Coal	Captive Power
Hindalco Industries Ltd., (Unit Birla Copper), Dahej, Gujarat	1	151	67	500	Lignite/Coal	Cogeneration
Bihar Caustic & Chemicals Ltd., Garhwa Road, Jharkhand	1	135	65	485	Coal	Captive Power
Hindalco Industries Ltd. (Unit Birla Copper), Dahej, Gujarat	2	150	95	535	Coal	Captive Power
Indian Aluminium Co. Ltd. (INDAL) Hirakud, Power Orissa	6	155/165	90.2	515	Coal	Captive Power
HEG Ltd. (Graphite Division) Mandideep Near Bhopal, M. P.	1	140	66	485	Coal	Captive Power
Jaiprakash Associates Ltd. Rewa, MP	1	170	87	515	Coal/ Washery Rejects/ Pet Coke	Captive Power

System features and advantages

- Natural circulation
- Tower-type design and long residence time of fuel particles and flue gases.
- Low fluidising velocities of 4 to 5 Meters/Sec.
- High carbon combustion efficiency of around 99% due to ash recirculation.
- No in-bed heating surfaces.
- Multi-fuel firing capability
- Simple fuel preparation without grinding.
- Low auxiliary power consumption.
- Cold cyclones with low refractory, operating at around 400°C, result in short - up and shut down time.
- Low emission values.
- Low ash recirculation rates and low dust load in combustor, preventing erosion.

Turnkey solutions in steam generation

ThyssenKrupp Industries India is in the field of design, manufacture, supply, installation and commissioning of a wide range of Steam Generating Plants for various industrial applications. The boilers service the diverse needs of different industries with multi-fuel capability, efficiency and environment friendly steam generation capabilities.

The boiler range covers water tube boilers up to 500 tph including

- CFBC Boilers
- Oil & Gas Fired Boilers
- Waste Heat Recovery Boilers
- Unconventional Fuel Fired Boilers
- Sugar Boilers (Dumping / Travelling grate)

Quality Assurance

Stringent quality control measures have earned ThyssenKrupp Industries India the ISO 9001 Quality Management System certification and the 'S', 'U' and 'PP' certificates of authorisation from ASME.

Quality Assurance involves everything - starting from the planning and designing of the product and ending with trouble-free plant performance in the hands of satisfied customers.

And standing testimony to the quality in-built into every plant, system and equipment supplied by ThyssenKrupp Industries India are the many repeat orders.