Packaged Firetube Boilers
Firetube Boilers

- Produce saturated steam for process
- Capacities: 0.5 t/h up to 20 t/h
- Steam conditions: 7-20 bar saturated steam
- Fuels: Gas, HFO, LFO, coal and wood
- Furnace and combustion equipment arrangements
  - Swinging chutes & chain grate stoker for coal
  - Stationary grate for firing logs
  - Brick set step grate furnace for fibrous fuel firing
  - Water cooled cylindrical furnace for gas/oil firing
Package Boiler

![Diagram of a package boiler system](image)

- **Boiler**
- **Grit Arrestor**
- **Stoker**
- **FD Fan**
- **ID Fan**
Coal Fired Firetube Boiler Installation
Industrial Watertube Boilers
Industrial Watertube Boilers

- Produce superheated steam for power generation
- Capacities: 20t/h up to 200t/h
- Steam pressures: 20-110 bar
- Superheated steam: 280-540°C
- Fuels: Gas, HFO, LFO, coal and fibrous biomass
- Combustion equipment and furnace configurations
  - Pneumatic fuel spreading of biomass and coal
  - Dump or steam cleaned grate for suspension firing
  - Moving grate for firing coal and high ash biomass fuels
  - Burners for gas, LFO and HFO
  - Water cooled furnace with membrane wall construction
Watertube Boilers

Configured for different fuels e.g.:

- Sugar industry – bagasse & coal
- Paper industry – woodchips and bark
- Petro-chemical industry – oil or gas
Typical Bi-drum Sugar Mill Boiler

- Primary fuel - Bagasse
- Secondary fuel - Coal
- 50-200 t/h
- 3 100-8 200 kPa
- 385-520°C
- Power generation boilers
- Bagasse feeders
- Coal bunker & feeders
- Pneumatic spreaders
Fuel Feeders on Coal/Bagasse Boiler
Pneumatic Fuel Spreader
Moving Grate
Efficient Combustion
Stationary Steam Cleaned Grate
Heat Recovery Tower
Latest Developments
Market Trends and Demands

- Need for electrical power in developing world
- Need for medium to small, efficient power stations
- Conversions of process steam plants to co-gen plants
- High fuel costs – need for energy security
  (Use fuels locally available to displace imported oil products)

  - Small power island with optimised cycle efficiency
  - Small higher pressure biomass / coal fired power boilers
  - Emphasis on efficient combustion of coal and biomass
  - Improved plant reliability to provide secure power supply
Increased cycle efficiency
Cycle Efficiency = f(Steam Pressure)

- Cycle efficiency increases with increase in steam pressure
- Demand for boilers pressures of 8 200 – 11 000kPa(g)
Bi-drum vs Mono-drum at higher pressures

- Disadvantages of bi-drum design at higher pressures
  - Drum drilling requires very thick walls
  - Expanded tube construction no longer possible
  - Reduced effectiveness of evaporation bank at high pressure

- Advantages of mono-drum design at higher pressures
  - Single drum with relatively thin wall
  - Evaporation bank reduced in favour of larger superheater
  - Emphasis on large banks of economiser
  - Fully welded pressure part construction
From Bi-drum to HP Mono-drum
High Pressure Mono-drum Boilers

- Coal and biomass
- 120-250 t/h
- 8 200 – 12 000kPa
- Fully welded construction
Small Biomass Fired Power
20t/h Biomass/Coal Fired Boiler

- MicroGen Boiler
- 20t/h steam
  - Up to 61bar(g)
  - Up to 460°C
- Fuel: Coal or Biomass
- Efficient
- Compact
- Short delivery
- Quick installation/erection
- Modular power station
Combustion Equipment

CAD stoker & pneumatic spreaders
Pressure Envelope
Computational Fluid Dynamics
Computational Fluid Dynamics (CFD)

- Combustion modelling
- Thermal modelling
- Accurate prediction of radiation into the superheater
- Mitigate erosion risk
  - Model of particle trajectories for potential erosion
- Mitigate tube failures due to insufficient circulation
  - Model of heat flux profile in the furnace
CFD - Flame Profile in Furnace
CFD – Reducing Unburnt in Fly Ash
CFD – Different Secondary Air Distributions
CFD – Flame Profile in the Furnace
CFD – Increasing Furnace Residence Time
CFD – Particle Trajectories by Size
CFD – Particle Trajectories by Size
Biomass: Velocity of Particle Tracks
CFD - Heat Flux for Circulation Assessment

Contours of Total Surface Heat Flux (W/m²)

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ANSYS FLUENT 13.0 (3d, pbns, spe, rke)
Thank you