



***Babcock & Wilcox's
IR-CFB Boiler Technology***

S. P. Ganeshan

Divisional Manager, Thermax Limited, Boilers & Heaters Group

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Thermax - Vision



To be a globally respected high performance organization offering sustainable solutions in energy and environment

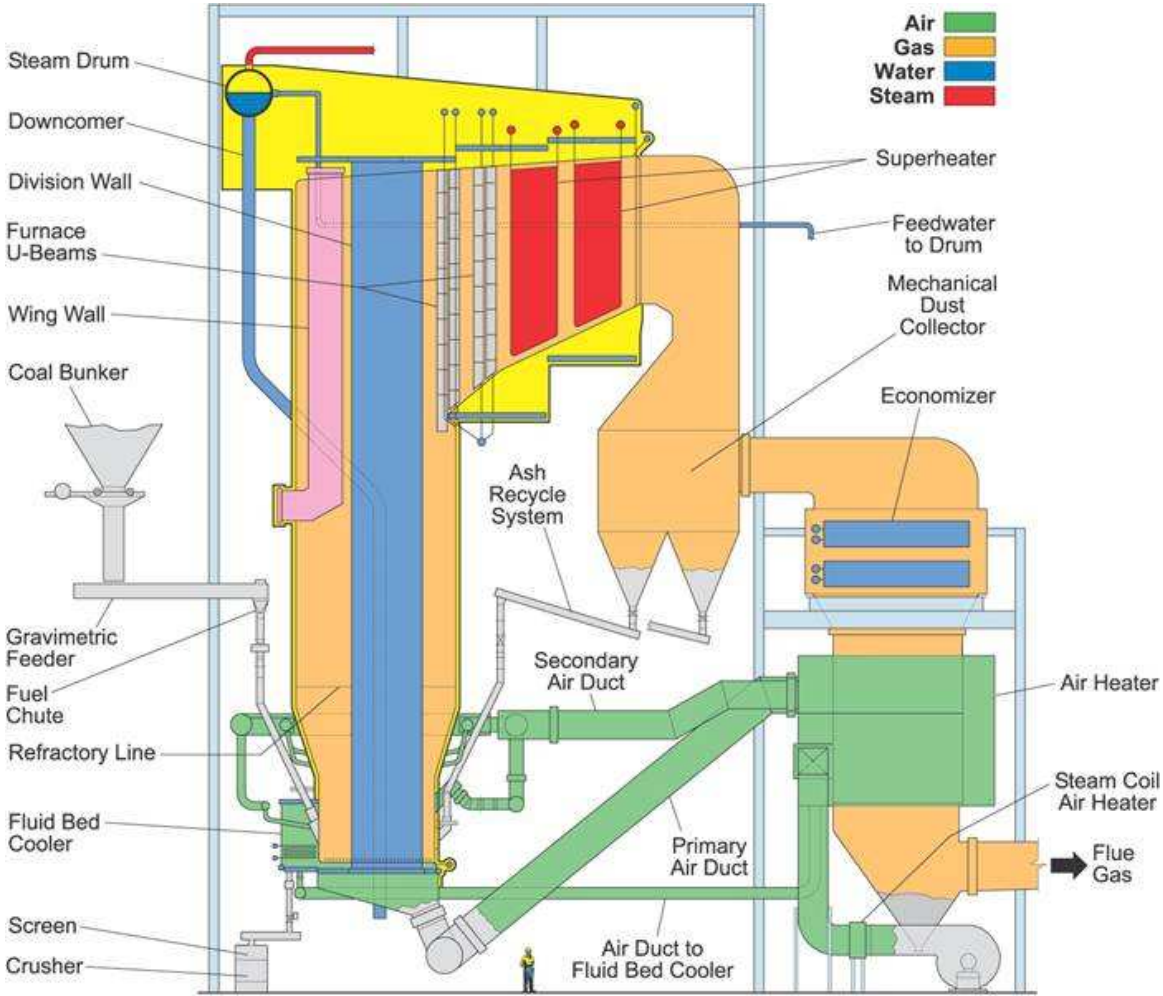


IR - CFB TECHNOLOGY

Technology Partnerships for CFBC BOILERS

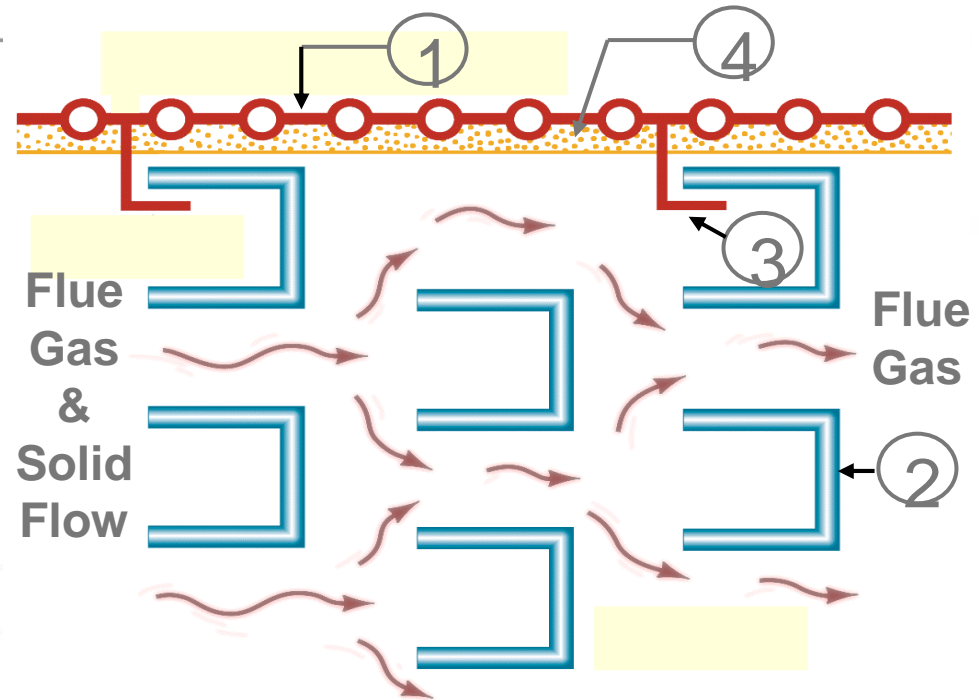
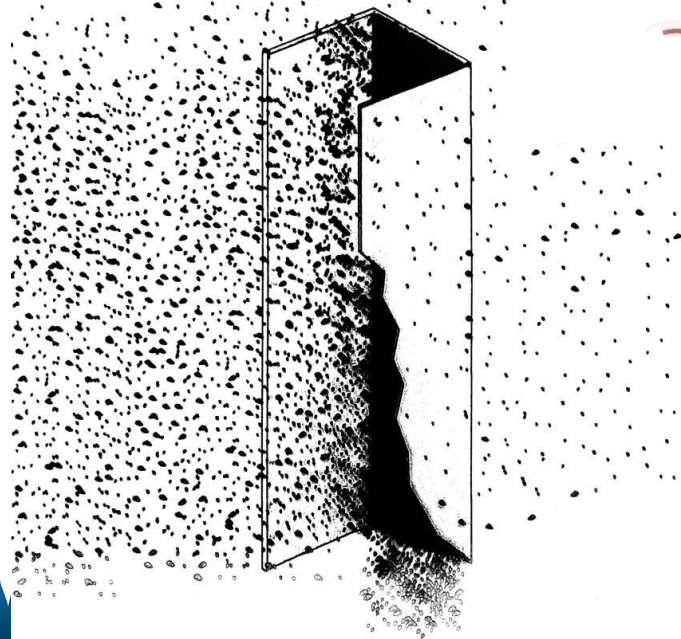


Internal Recirculation – Circulating Fluidized Bed Boiler (IR-CFB) Boiler (IR-CFB)

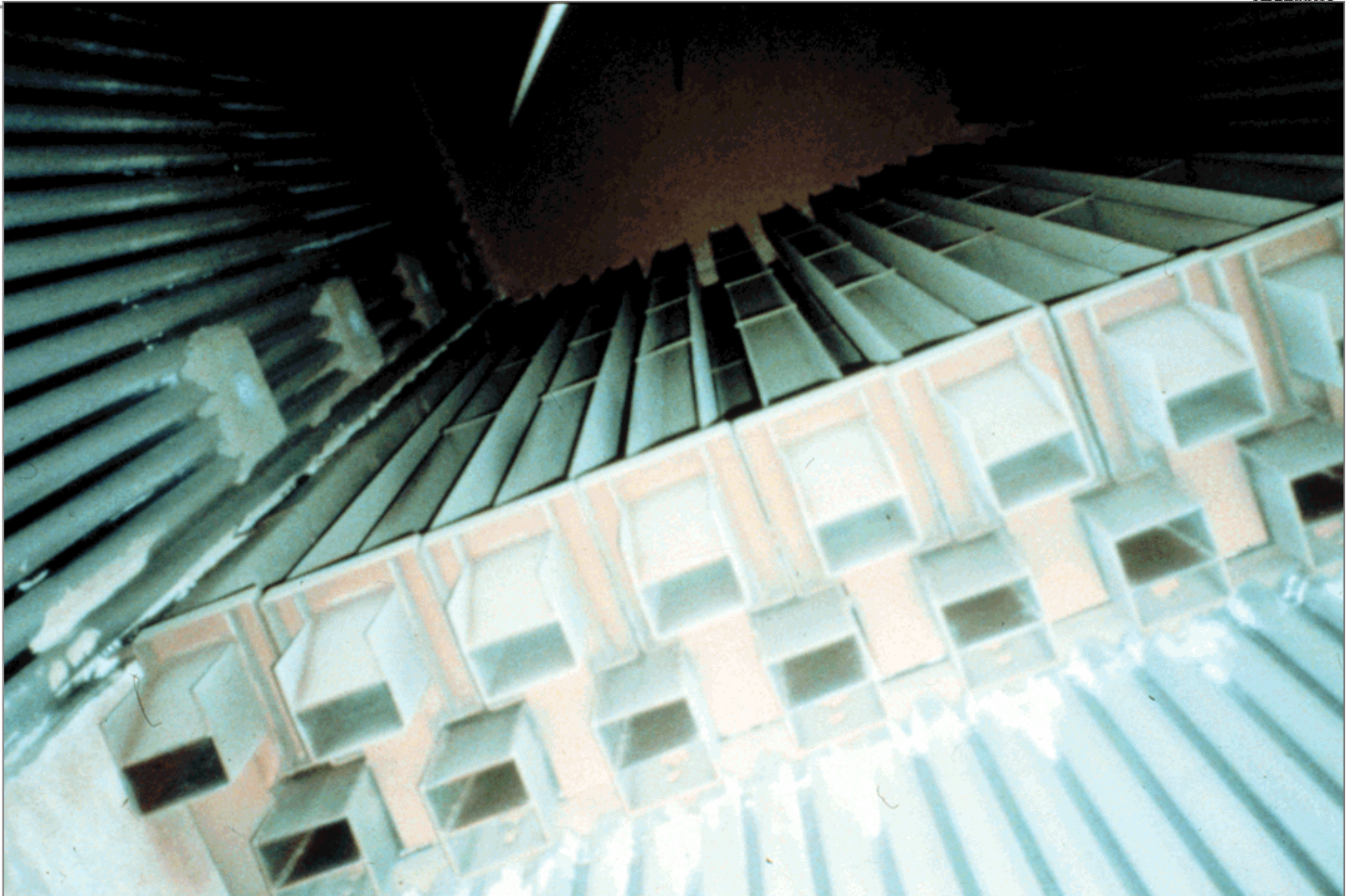


U-Beam Separators

- 1. Sidewall
- membrane panel
- 2. U-beam - SS309H/
• SS 253MA
- 3. Seal baffle
- 4. Refractory

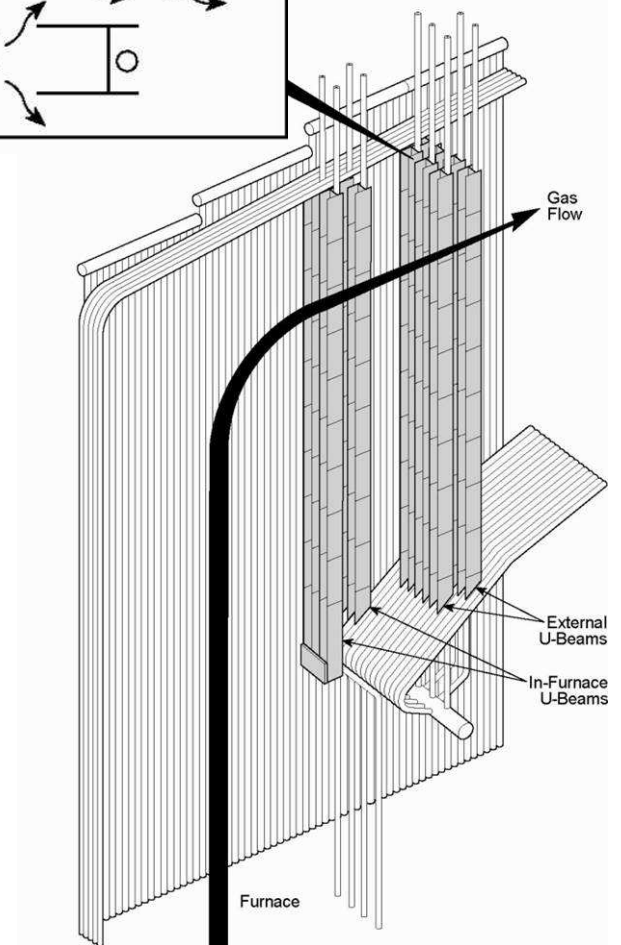
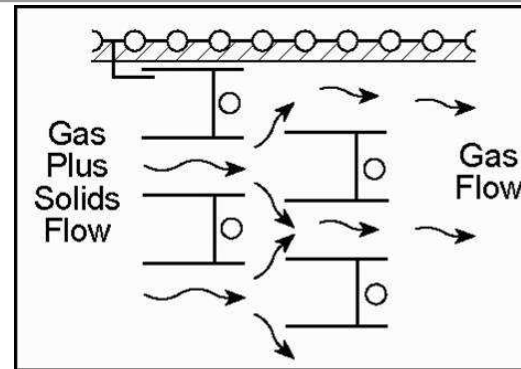


U-Beams



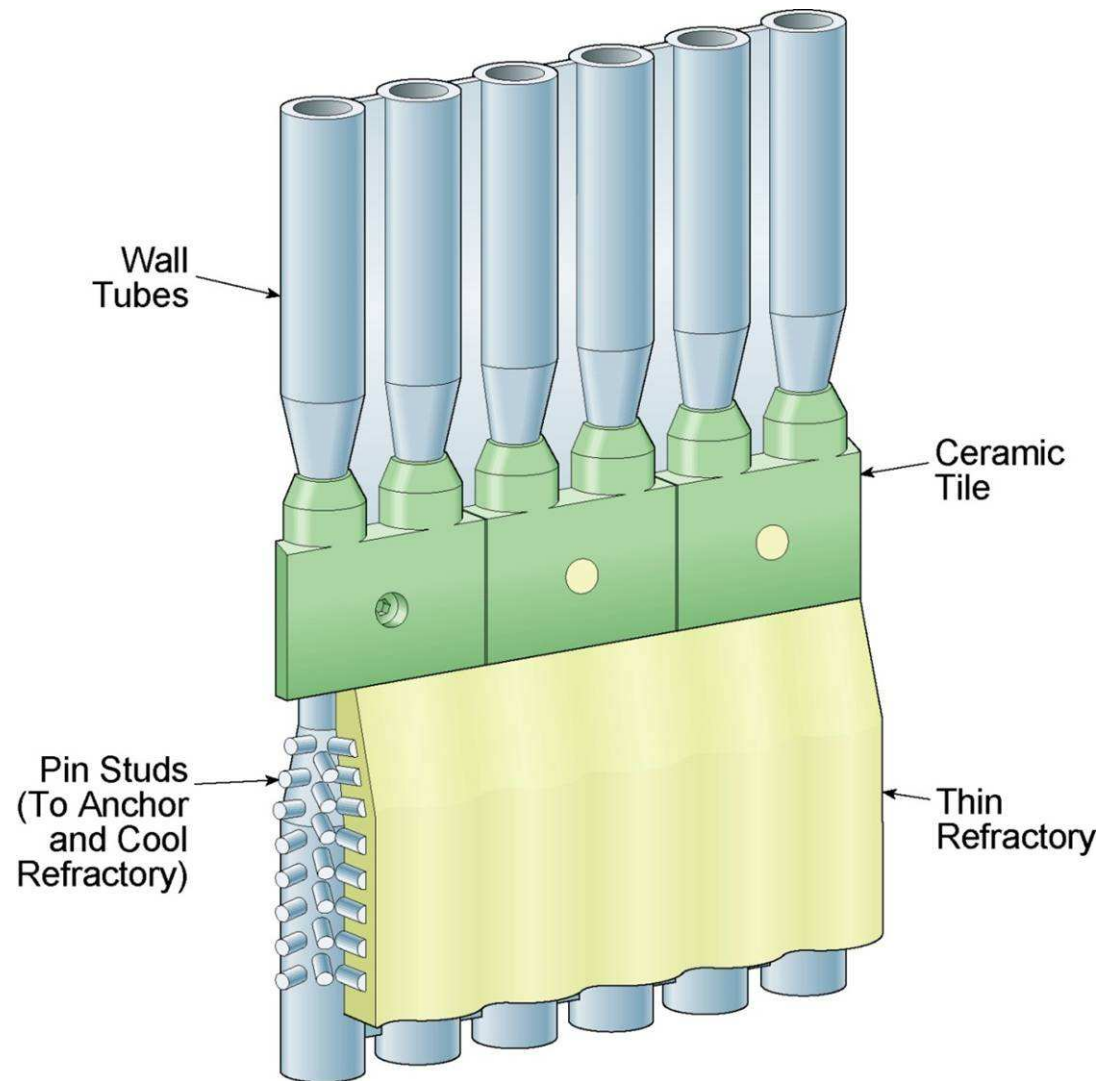
U-Beam Separators – for High capacity units

- Sidewall membrane panel
- U-beam - SS309H / SS310H/RA253MA
- Seal baffle
- Refractory



CFBC TECHNOLOGY IMPROVEMENTS

Reduced Diameter Zone (RDZ)



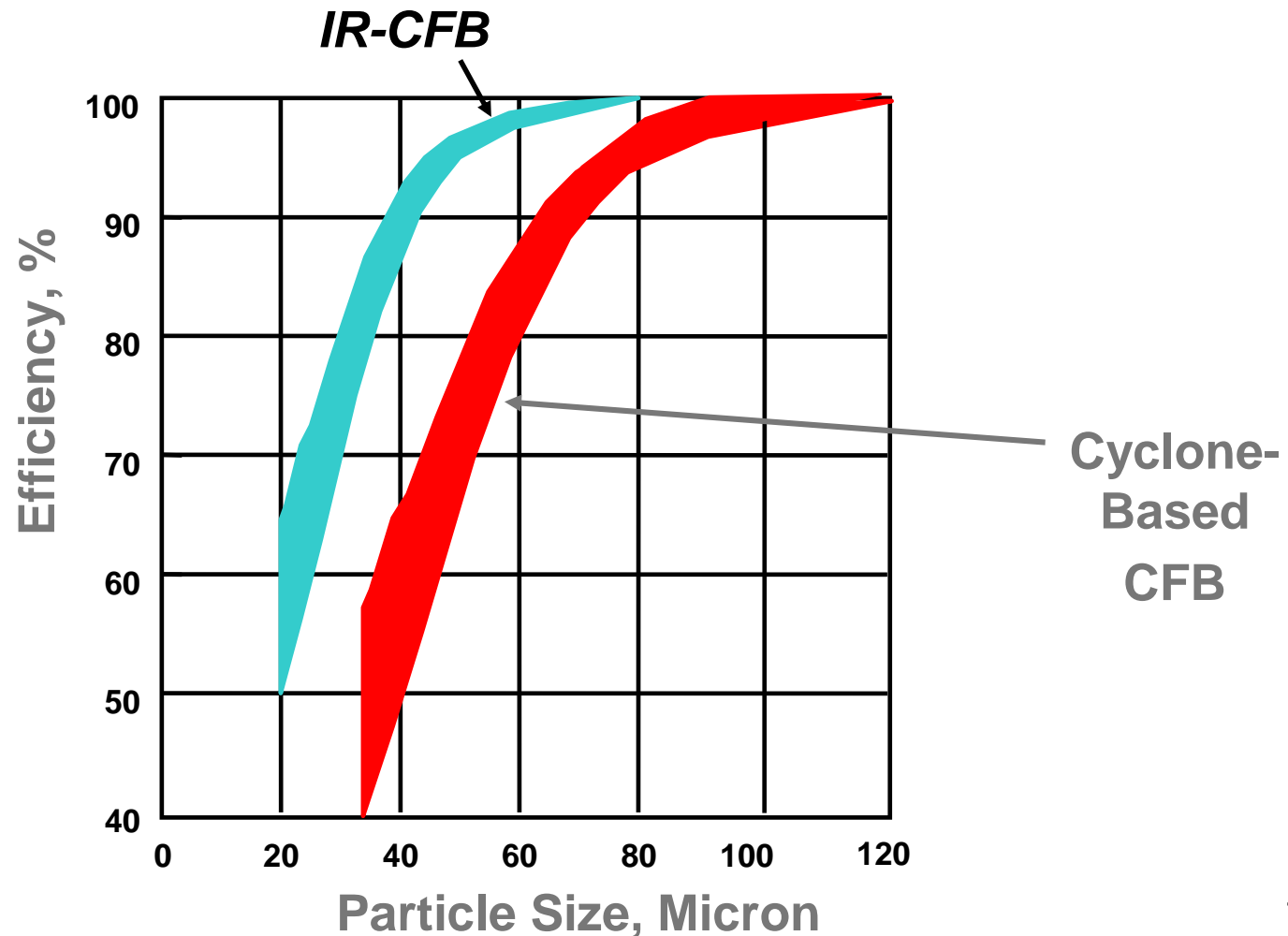
WHY IR - CFBC?

- HIGHER SEPARATION EFFICIENCY EVEN AT LOWER PARTICLE SIZE.
- HIGH FURNACE DENSITY
- UNIFORM FURNACE TEMPERATURE THROUGHOUT THE FURNACE.
- THIN REFRACTORY.
- TYPICAL BUBBLE CAPS TO AVOID BACK SHIFTING
- LOWER OPERATING & MAINTENANCE COST

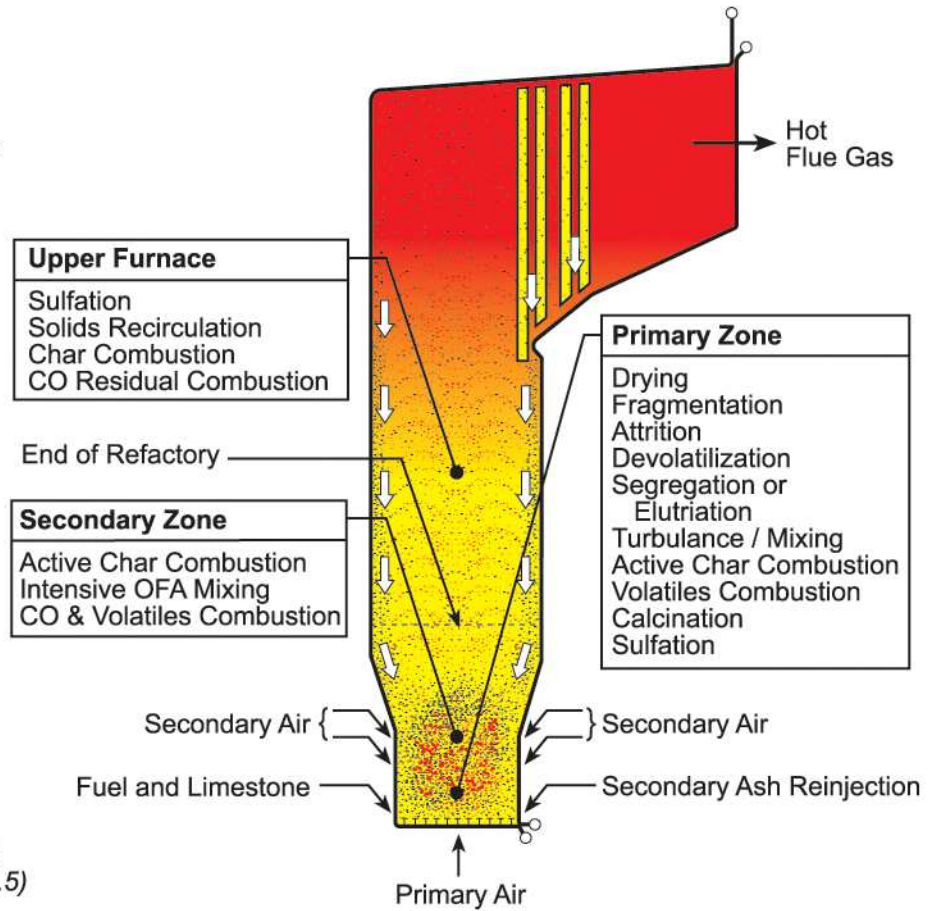
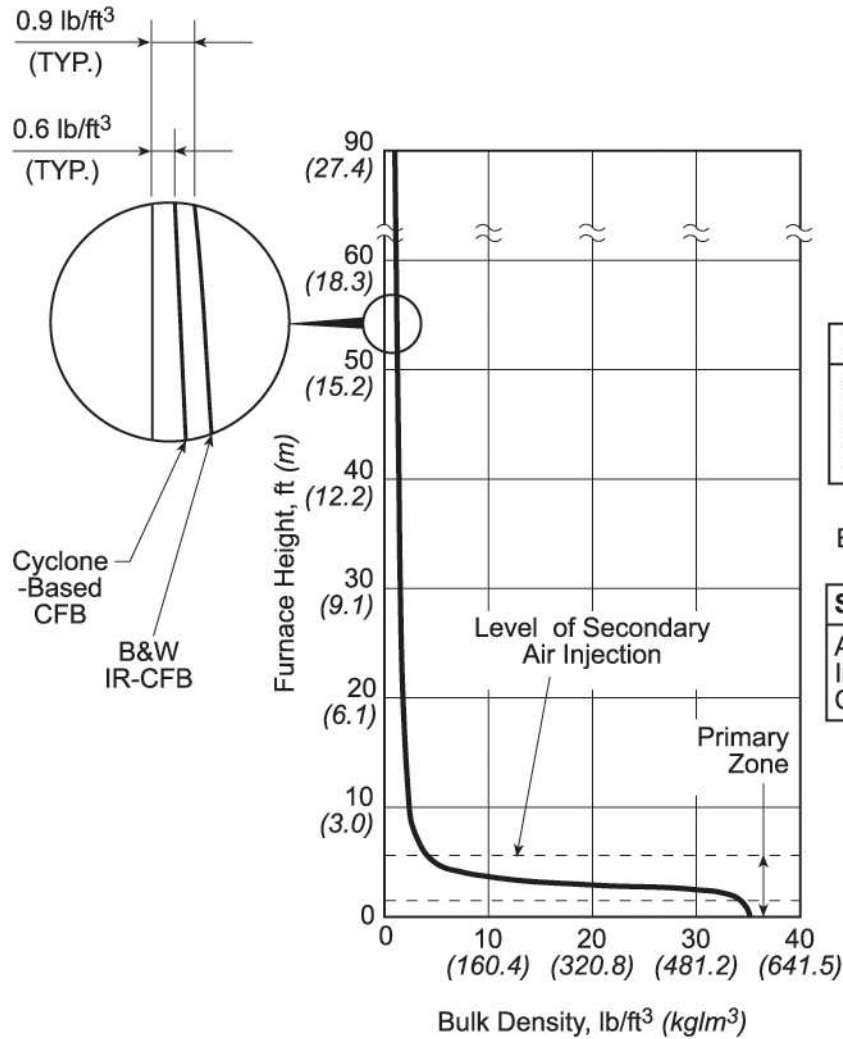
Overall Grade Separation Efficiency Comparison



•IR-CFB Two Stage Solids Collection vs Hot Cyclone CFB Collection



IR-CFB Boilers - Furnace Density Profile

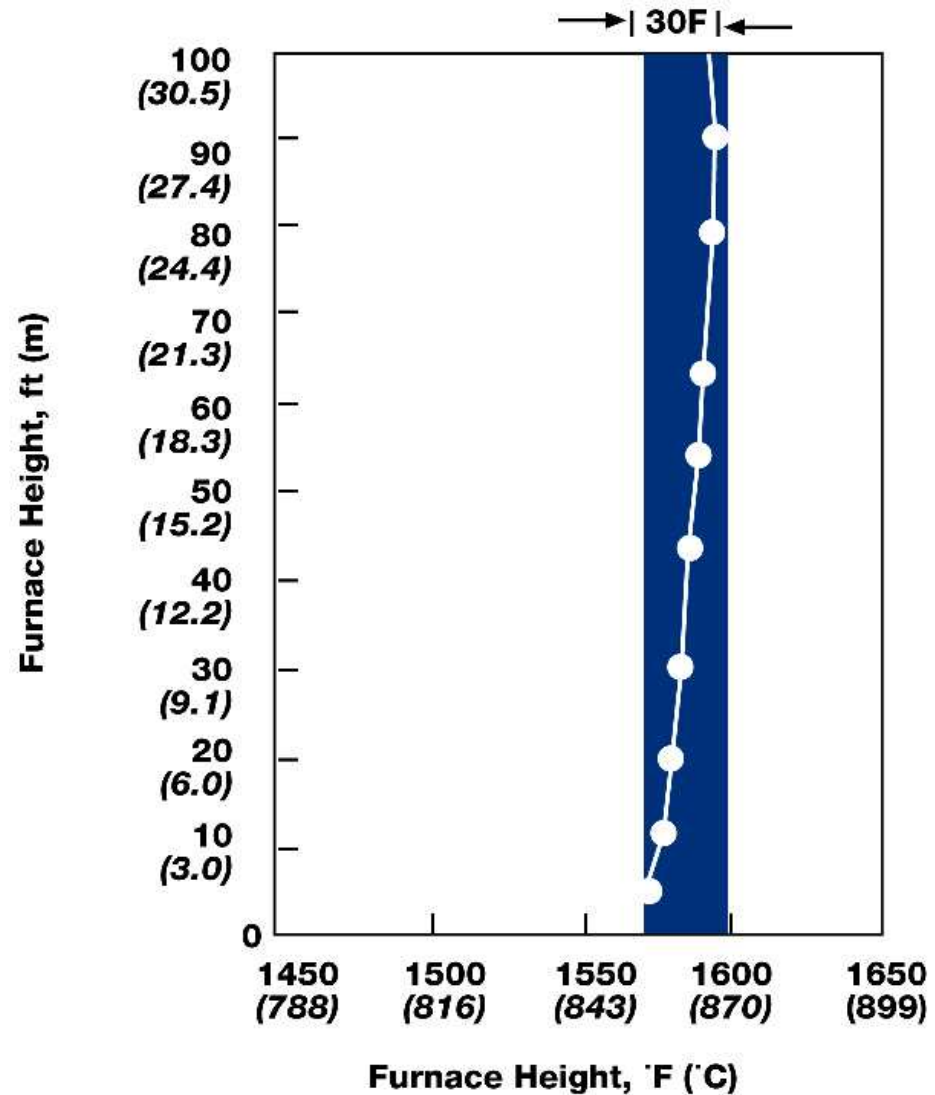


IR-CFB Furnace Predicted Temperature Profiles



Benefits:

- Low NO_x
- SO₂ capture across furnace height

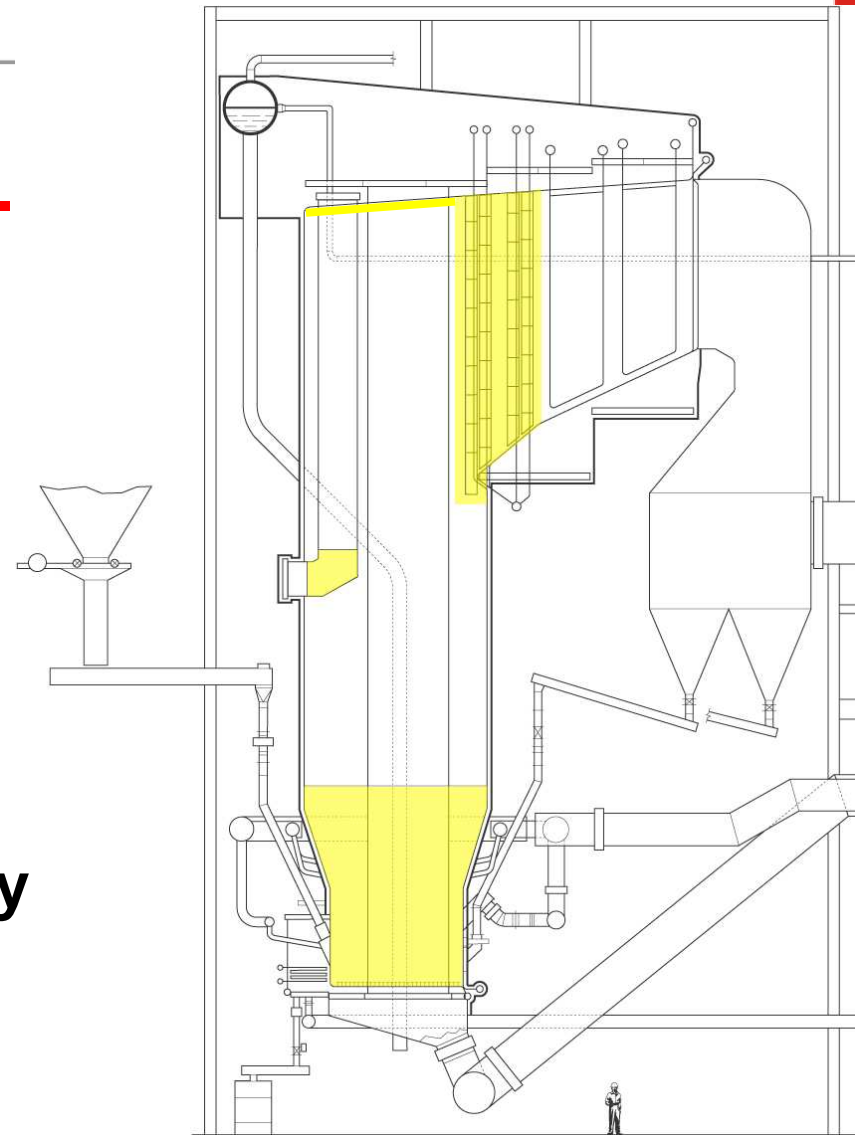


Thin Cooled Refractory

90% less refractory in IR-CFB

NO hot expansion joints as compared to hot cyclone type CFB's

Low gas velocity through U-beam collector significantly reduces need for refractory



(Refractory highlighted in yellow)

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IR-CFB Features / Benefits



- High upper furnace heat transfer rate and precise furnace temperature control
 - *Result of high efficiency solids collection and solids recycle control from the MDC*
- Extended turndown ratio (no oil/gas)
 - *100% to 20% MCR*
- Low auxiliary power requirements
 - *Due to low flue gas ΔP and no fluidizing blower*

IR-CFB Features / Benefits



–Fast shut down / cool down

- *80%+ of bed material is drained during cool down. Can shutdown / cool / enter / re-start within a 24 hour period compared to 2 to 3 times longer for competitor CFB designs.*

–Low Maintenance Costs

- *No refractory or hot expansion joints, 'RDZ' at lower furnace refractory interface, no fluidized sealing system, low furnace exit velocity, low gas velocity in convective heating surfaces,...*

IR-CFB Boiler (110 Tons/Hr) at Kanoria Chemicals, (Renukoot, Uttar Pradesh)



IR-CFB Boiler at BILT (Chandrapur, Maharashtra)



IR-CFB Boiler Technology -- Concluding Remarks



- IR-CFB facilitates Efficient boiler operation with precise process control ensured with two-stage solids separation system with controllable secondary recycle
- Internal recycle of the bulk of circulating solids and a wide range of furnace velocity allows a flexible, compact, cost-effective and high performance CFB boiler design suitable for multiple fuel firing applications
- Lessons learned from the operating units led to development of IR-CFB boiler technology suitable to various fuels / Indian conditions.
- Operational experience, a significant commercial reference list, and technical developments illustrate the superiority of IR-CFB boiler technology and trends of IR-CFB technology