DESIGN COST CUTTING & FAILURES IN BOILER

Boiler is given guarantee of engineering / design for life span of around 25 years but trouble starts within a short time period due to engineering issues comes on surface.

In my professional career, I understand that, few changes are made purposefully against essential requirement in the engineering norms for cost cutting in boilers, auxiliaries to re-sell products against failures and get after sales services / spares business from customer.

Then they suggest few changes in engineering / design to re-sell product. Later, they implement the Improved Design to get business, while it should have come in the first stage of execution.

If Not Specified in Contract & ignored by Consultant, SELLER will try to reduce cost and quality by below mentioned points:-

1. Reduce List of mandatory spare items
2. Reduce furnace height upto maximum extent limit,
3. Change in type of boiler support like Top support, Bottom Support, Centre support
4. Reduce Staircase width 1000 mm upto operating platform & above 750 mm only
5. Supports Cantilever for soot blower / other platform upto 3 meters
6. Coal spreading by Pneumatic Spreader in Grate Boiler to avoid Mechanical spreader
7. Reduce Header length by placing valves in offset position at header
8. Water wall panel / Economiser tube thickness reduction to 3.66 mm from 4.0 mm. Initially, in old supplied boilers, water wall tube thickness was 4.5 mm.
9. Increment in Water wall panel tube pitch for 63.5 mm O.D tubes from 88 mm to 100 mm
10. Pipe / Header / Down comer / Riser size reduction by increasing velocity & avoiding unbalance factor in calculation. Change in Material grade by avoiding unbalance factor.
11. Avoid Rifle tube selection for bed coil in AFBC Boiler.
12. Change in - Air nozzle design of furnace bed, Refractory material & it's application, Cyclone separator design, Ash cooler design, Pollution control equipment sizing, Changes in number of Essential Instruments, Height of canopy above steam drum, Secondary Air distribution-Over Fire Air, etc
13. Changes in - Circulation Ratio of boiler, Furnace Bed height, Flue gas residence time in furnace, High Water Flow in Spray system for Steam Temperature control

BASIC ENGINEERING / DESIGN FAILURES in BOILER:-

1. Pressure parts failure in CFBC boilers, AFBC boilers & Other Boilers
2. High Furnace bed temperature (>900 degC) in Fluidized Bed Boilers. It will increase Fouling and NOx emission.
3. Furnace Bed shifting & Bed material shifting in Wind box
4. Furnace, Economiser, APH casing vibration (Trying to arrest by jack bolt/guide lock OR by restricting expansion movement)

5. Bed Coil & Bed Superheater tubes failures (AFBC Boiler), even half sleeve – full sleeve / refractory installation.
6. Failure of Riser going to steam drum due to FAC (Flow Accelerated Corrosion)
7. High temperatures in Ash hopper, Frequent Chocking of flue gas path due to fuel carryover and secondary burning in Biomass and Slop fired Boiler
8. High back end-APH outlet–gas temperature (>200 degC) & heavy furnace pressure fluctuation with back firing in Biomass and Slop fired Boiler
9. APH tube thickness change (S.S. tube of 1.0 mm not effective)
10. ID fan impeller water cleaning (Due to ash carry over & non performing ESP / Bag filter / Wet Scrubber / Cyclones
11. Low Pressure Drop across Superheater coils lead to flow unbalance & tube failure.

Example on Boiler Feed Pump (BFP) Selection @Cost Cutting

BOILER FEED PUMP & DEAERATOR SIZE SELECTION

BASIC CONSIDERATION in BFP DESIGN SELCETION	UNIT	Boiler running @100% MCR	Boiler running @110% Peak Load
Boiler Peak Load %	% MCR	**100**	**110**
Blowdown loss % in boiler	% MCR	**3**	**4**
Number of Boiler feed pump	Nos.	1	1

Boiler MCR capacity	kg/hr	100,000	100,000
Total Feed Water Flow @ Boiler Peak Load	kg/hr	100,000	110,000
Flow handled by each Boielr feed pump	%	100	100
Additional water requirement	kg/hr	0	0
Feed water flow at MCR considering Blowdown loss	kg/hr	103000	104000
Feed water flow at Boiler Peak Load including Blowdown loss	kg/hr	**103000**	**114000**
Feed water temperature	deg.C	125	125
Feed water density	kg/M3	938	938
Design flow margin	%	10	10
Design pressure margin	%	5	5

BOILER FEED PUMP DISCHARGE PRESSURE SELECTION

Steam pressure at battery limit	kg/cm^2g	20.00	20.00
Super heater header pressure	kg/cm^2g	20.00	20.00
Super heater Safety Valve set pressure Margin %	kg/cm^2g	**0.00**	**5.00**
Super heater Safety Valve set pressure with/without Margin	kg/cm^2g	20.00	21.05
Super heater pressure drop	kg/cm^2g	0.5	0.5
Max. Steam drum operating pressure	kg/cm^2g	20.50	21.55
LHS Steam drum Safety Valve set pressure	kg/cm^2g	22.00	23.05
RHS Steam drum Safety Valve set pressure - BOILER DESIGN PRESSURE	kg/cm^2g	22.50	23.55
Static head	kg/cm^2g	1.8	1.8
Pressure drop across Economiser	kg/cm^2g	1.5	1.5
Pressure drop across HP heater	kg/cm^2g	0.5	0.5
Pressure drop across control valve & piping	kg/cm^2g	4.5	4.5

BFP discharge pressure at 100% MCR with design pressure margin @5%	kg/cm^{2}g	32.34	33.44
BFP discharge Head at 100% MCR with design pressure margin @5%	MWC	**345**	**357**
Boiler feed pump capacity at MCR	M3 / hr	109.81	110.87
Boiler feed pump capacity with design flow margin @10%	M3 / hr	**120.79**	**133.69**
Boiler feed pump capacity with design flow margin @10%	TPH	**113.30**	**125.40**

DEAERATOR SIZE SELECTION		Boiler @ 100% MCR	Boiler @ 110% Peak Load
Deaerator size @ MCR Boiler Loading with Margin	% MCR	120	130
Water Storage time for deaerator Tank	Minutes	8	8
Deaerator capacity	M3/hr	127.9	138.6
Water Storage Tank volume	M3	**14.2**	**15.6**

BASIC ENGINEERING / DESIGN RULES for BOILER:-

1. Excess Air: 20 to 25% max. in AFBC Boiler. Excess Air is directly proportional to increment in Fluidization Velocity
2. Fluidization Velocity: 2.5 m/s max. in worst case in AFBC Boiler. Erosion rate is directly proportional to increment in Fluidization velocity.
3. Furnace Bed Temperature is directly proportional to increment in Fluidization Velocity and reduction in Residence time in Furnace.
4. Furnace Bed Temperature: 900 degC max. Depend on Ash fusion Initial deformation Temperature (IDT) on oxidizing and reducing medium.
5. Un-burnt Carbon Loss: Directly proportional to Fixed Carbon, Fluidization Velocity and inversely proportional to Furnace Height, Furnace Bed Temperature and Excess Air.
6. Attemperator / Spray water: 50 degC min. above Saturation temperature of steam at downstream (outlet)
7. Soot Blowers installation for over-bed firing including Over-fire air system installation @400 mmwc min. at all desired elevation
8. All essential major measurement points are provided with adjacent temperature test pocket for local measurement & calibrating.

M/s Unite Energy Corporation LLP is keen to provide the Spares, Sales & Services, Retrofit & Site Repairs of Boiler & Auxiliaries, Performance Evaluation, Shop & Site Fabrication, Erection & Commissioning, Design Modification & Feasibility Study, Consultancy & troubleshooting support to mitigate the irregularities in the plant, minimize breakdown & downtime and improvise design & system performance to improve the overall plant's health and performance.

Regards

Pramesh Kumar Jain
Chief Executive- Technical
Mobile: **+91 9868499319**
Email: **pramesh.uniteenergy@gmail.com**
Unite Energy Corporation LLP, Ghaziabad, U.P., INDIA

WE WISH A "HAPPY NEW YEAR 2023"

WELCOME TO A NEW JOURNEY WITH NEW GOAL