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ECONOMICALLY ANALYSIS OF REGENERATIVE AIR PREHEATER IN THERMAL POWER PLANT

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Abstract - *This paper presents economic analysis of Regenerative air preheater in thermal power plant. This work is focus on performance of air preheater, before and after axial seal plate, radial sector plate clearance adjustment. This work based on routine operation data measured onsite at Chhabra thermal power project, Rajasthan, India. The Air pre heater is a rotating device that transfers heat from flue gas to incoming cold air for combustion in the furnace. Modern power plants are uses air preheater as auxiliary of boiler. Air preheater reduces coal consumption due to waste heat recovers from flue gas. Boiler efficiency increases due to utilize of waste heat and decrease unit heat rate. Analysis of saving coal consumption and fans loading after and before modification has been carried out in this research paper.*

Key Words: **Air preheater, seal plate, radial sector plate, boiler efficiency**

1. INTRODUCTION

Modern power plants generally use air preheater to increase thermal efficiency of boiler. Air pre heater is an important of boiler auxiliary, which primarily preheat the air for rapid and efficient combustion in the furnace. Air preheater typically accounts for over 10 % of boiler efficiency. If the cold air for combustion is not preheated, more fuel consumption will takes place which increase overall cost and decrease the efficiency of the plant. [1] The deterioration of air preheats performance as more leakage and basket fouling or plugging. The tri-sector module is passing section into the flue gas 180°, primary air 72° and secondary air 108° out of 360° angle of air preheater. [3]

2. HEATING ELEMENTS

The heating element is a compact arrangement of formed metal sheets contained in the rotor in two or more layers. The baskets element at the cold end, where air is admitted and flue gases are discharged can removed through an access door in the air preheater housing without disturbing sealing members of the preheater components. [2]

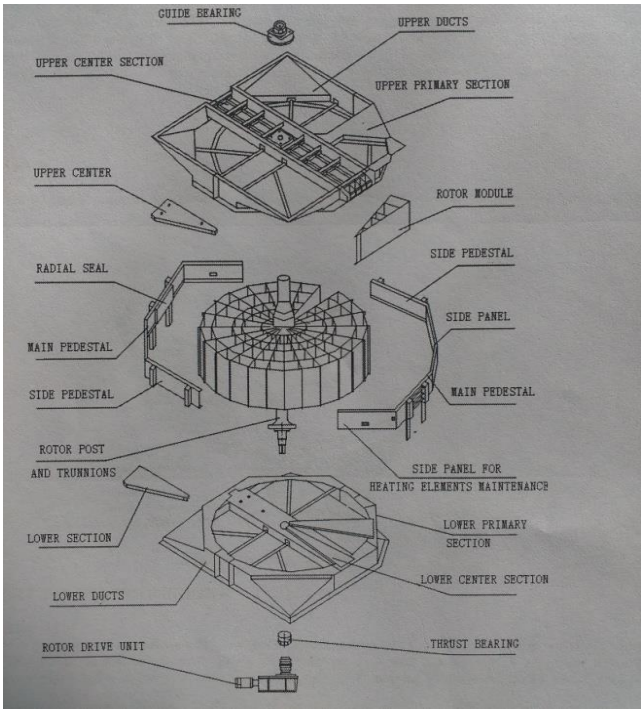

Fig -1: Tri-sector module air preheater [4]

3. SEALING SYSTEM

It is an implied requirement that the rotating parts should have some working clearance between their static parts to avoid any interference between them. Rotor is constructed to have high clearance to take care of their thermal expansion and these gaps are closed by flexible seals. These seals are classified into the following three major types [2]

- Radial seals
- Axial seals
- Bypass seals

Seals clearance take after adjust axial seal plate and radial sector plate shown in the below the table

Table -1: Seals Clearance [4]

S. No.	Seals	State	APH A Clearance	APH B Clearance
1	Radial Seal	Hot End Inboard	0.2 mm	0.4 mm
		Hot End Outboard	0.4 mm	0.3 mm
		Cold End Inboard	0.5 mm	0.4 mm
		Cold End Outboard	13 mm	13 mm
2	Axial Seal	Hot End	7.7 mm	7.8 mm
		Cold End	4.4 mm	4.6 mm
3	Bypass seal	Hot end	4.1 mm	4.1 mm
		Cold End	1.1 mm	1.1 mm

4. PROFIT GAINED AFTER MODIFICATION

Air preheater is modification then after saving of cost calculates as coal consumption and fans loading.

Table -2: Fans Current and others parameter [4]

S. No.	Parameters	Before Modification		After Modification	
		Fan A	Fan B	Fan A	Fan B
1	Unit Load	250 MW		250 MW	
2	Fuel Consumption	148 T/Hr		146 T/Hr	
3	PA Fan Current	82 Amp.	81 Amp.	64 Amp.	61 Amp.
4	FD Fan Current	31 Amp.	33 Amp.	30Amp.	32 Amp.
5	ID Fan Current	170 Amp.	172Amp.	165 Amp.	159 Amp.

4.1 Air leakage

The method determines air pre-heater as per this procedure is the volumetric method. This is an empirical approximation of air pre-heaters leakage.

Oxygen in air preheater (O_2) = 3.2
Oxygen leaves air preheater (O_2) = 5.3

$$AL = \frac{(O_2 gi - O_2 ge)}{(21 - O_2 gi)} * 0.9 * 100$$

$$AL = \frac{5.3 - 3.2}{21 - 5.3} * 0.9 * 100$$

$$= 12.03\ \%$$

4.2 Coal cost saving per hour

Coal consumption before modification= 148 T/Hr.
Coal consumption after modification = 146 T/Hr.
Coal consumption saving per hour = 148-146 = 2 T/Hr.
Coal cost per hour = 4000 * 2
= Rs 8000
Cost of coal saving per year = 8000 * 24 * 365
= Rs 70080000/-

4.3 Cost Benefit due to fan loading (Current)

Total fans current before modification =569 Amp
Total fans current after modification = 511 Amp
Total saving fans current =58 Amp
Power =1.732 * V I * CosΦ
Power saved =1.732 * (6.6 K) * 58 * 0.86
=570.18 KW
Energy saved per year =570.18 * 24 * 365
=4994846.88 KWHr
Energy cost per unit =Rs 2.60
Energy cost saving per year =Rs 4994846.88 * 2.60
=Rs 12986601.88

4.4 Total cost saving per year

=Rs 12986601.88 + 70080000
=Rs 83066607.72/-

5. CONCLUSION

The air preheater are more important of boiler auxiliary. The air preheater improves performance of the plant due to more heat transfer to incoming cold air for combustion. Cleaning of plugging or fouling reduce power consumption, unit heat rate and coal consumption. Overall performance and profit of power plant hence increase.

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