Strategy to achieve design draft power through Metallic Expansion Joints replacement in stage-I unit at FGUTPS.

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1.0 Problem

St-I units at NTPC Unchahar are equipped with Metallic Expansion Joints (MEJ).These expansion joints had completed their useful life and were never replaced since commissioning of the units in 1988-89.Lot of air ingress from flue gas Expansion joints and hot air leakage from primary expansion joints was taking place. Repair/Partial replacement had not served the purpose and there was no significant gain in APC or reduction in draft power could be achieved.

2.0 Impact of problem

(i) Restriction on unit loading whenever coal quality deteriorated.
(ii) No margin in ID fan operation.
(iii) Insufficient oxygen level at Economizer outlet.
(iv) High PA header pressure to be maintained which was detrimental for APH seal leakage.
(v) Constant high APH guide bearing area temperature.
(vi) Insufficient combustion

3.0 Analysis of problem

1. Air ingress in Air Preheater inlet and outlet expansion joints.
2. Repair of metallic expansion joints not possible as sheet of metallic expansion joints was eroded fully and welding/brazing was not possible.
3. Due to damaged expansion joints in flue gas path, duct repairing work not resulting in any saving in draft power.
4. Due to high air ingress through expansion joints and duct, ID fan always running at higher load.

4.0 Solution

4.1 Complete replacement of Metallic expansion joint was planned in St-I units. Replacement was planned during capital overhauling of unit-2 in Sep/Oct-2014 and unit-1 in Sep/Oct-2015.

4.2 Survey of complete ducts was done during running units. Increased loading points were identified in flue gas and primary /secondary duct using temperature gun. Based on the collected data, expansion joints having leakage were identified.

4.3 Following expansion joints were replaced in unit-2 & unit-1

Sl No	Location	Size and no of folds	Unit-2 (Sep-2014)	Unit-1 (Sep-2015)
1	FLUE GAS PATH ,ECO OUTLET	SIZE2450X6159 STYLE7	2	2
2	FLUE GAS PATH ,APH INLET	SIZE3364X8470 STYLE5	2	2
3	FLUE GAS PATH, (APH OUTLET-ESP INLET)	SIZE1812X6159 STYLE2	2	2
		SIZE1812X6012 STYLE2	2	2
		SIZE2425X2654 STYLE1	3	3
4	HOT PRIMARY AIR, APH OUTLET	SIZE2530X3260 STYLE1	2	2
		SIZE1739X1839 STYLE2	4	NIL
5	SECONDARY AIR, FURNACE	U TYPE EXPANSION JOINT	2	NIL
		EXPAN JOINT STYLE1 WB-CONNECTION DUCT	16	
6	HOT PRIMARY AIR TO MILL INLET	SIZE: 1170X1170 STYLE1	6	6
		SIZE: 1170X1170 STYLE1	2	2
		SIZE: 1170X1170 STYLE1	2	2
		SIZE: 1170X1170 STYLE1	6	6
	TOTAL		51	29

4.4. Following works were carried out during the replacement process

- Lot of permanent structures like staircases, platform grills, Superheater header drains, water and air lines, duct corners were cut and removed for lifting and placing the Expansion joints to respective places.
- Temporary locking of duct was done to prevent any misalignment.
- Cutting & dismantling of old expansion joints and seal plate.
- Edge preparation of the ducts before placement of the new expansion joints.
- Erection of new expansion Joint to their respective position.
- Alignment/ matching of new expansion Joint with respective duct.
- Fitting and welding of expansion joints and seal (protection)plate.
- Cutting of temporary locking supports after completion of the work.

5.0 Result of MEJ Replacement in unit-2 was as follows:

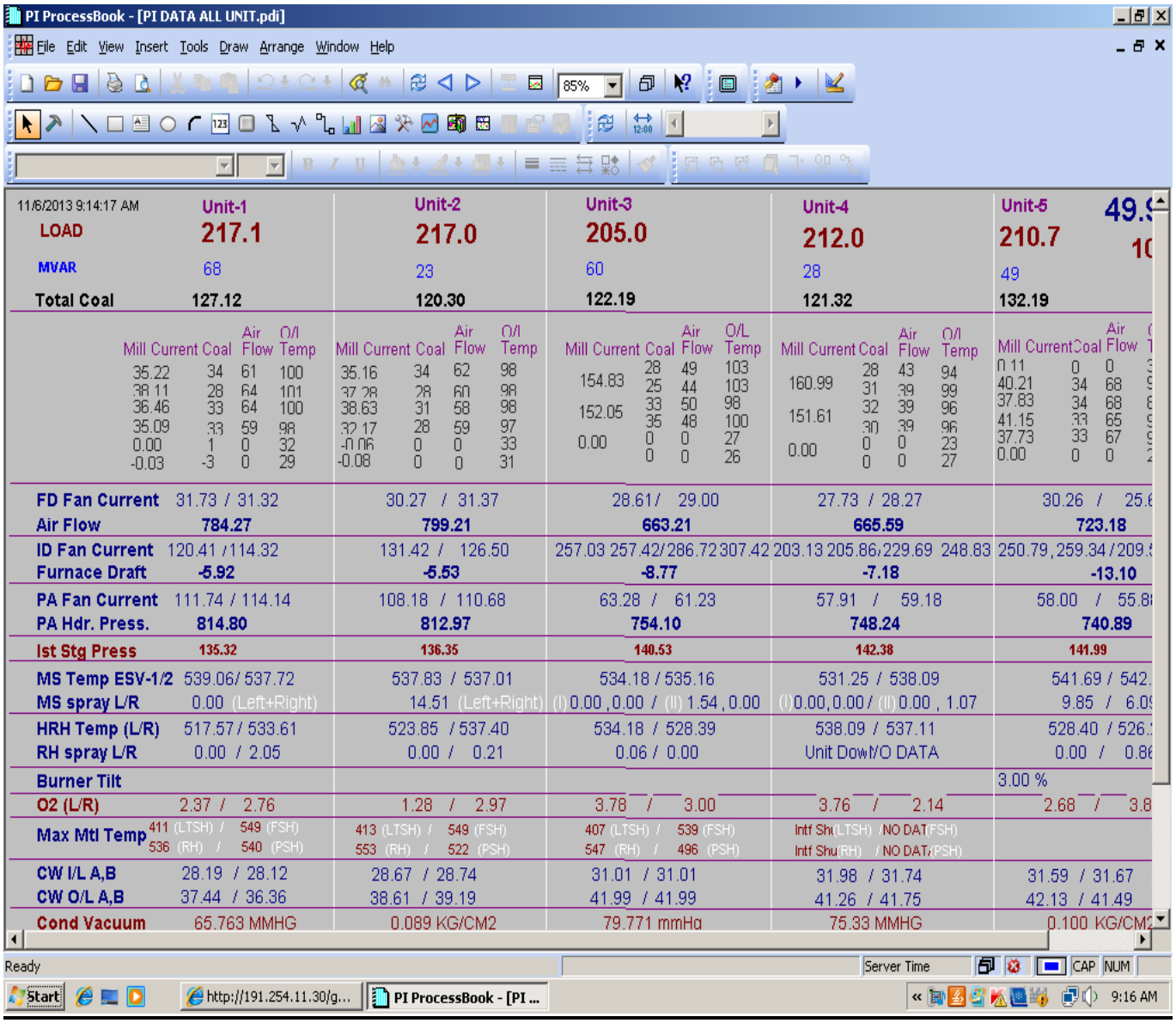
5.1 COMPARISON OF UNIT-2 DATA BEFORE AND AFTER OVERHAULING

Sl no	Date	06/11/2013 (Pre O/H)	15/11/2014 (Post O/H)	Remarks
1	Load	217	216.5	Same
2	TOTAL COAL	120.3	120.61	Same
3	AIR FLOW	799.21	805.69	Same
4	FURNACE DRAFT	-5.53	-8.39	Improved
5	FD FAN CURRENT	30.27 / 31.37	30.96 / 34.00	Improved
6	PA FAN CURRENT	108.18 / 110.68	106.34 / 105.33	Reduced
7	PA HEADER PRESSURE	812.97	782.23	Improved
8	O2 (L/R)	1.28 / 2.97	3.84 / 4.24	Improved
9	ID FAN CURRENT	131.42 / 126.50	104.78 / 97.86	Reduced
10	MILL IN SERVICE	A,B,C,D	A,B,C,D	Same

5.2 The following benefits are observed after replacement of MEJ

- ID Fan loading reduced from 135-140 Amps. pre overhauling to 95-100 Amps. post overhauling.
- Margin in unit operation to compensate for fluctuation in coal quality.
- PA Fan loading reduced. With less PA header pressure, significant reduction in APH seal leakage was observed.
- FD Fan loading was increased.
- Proper combustion of Coal in Furnace.
- No restriction on Unit loading.

5.3 With old MEJ Unit-1 &2 ID fan Current in range of 125-130 Amps.



5.4 After MEJ Replacement Unit-1&2 ID Fan Current in range of 100-103 Amps.

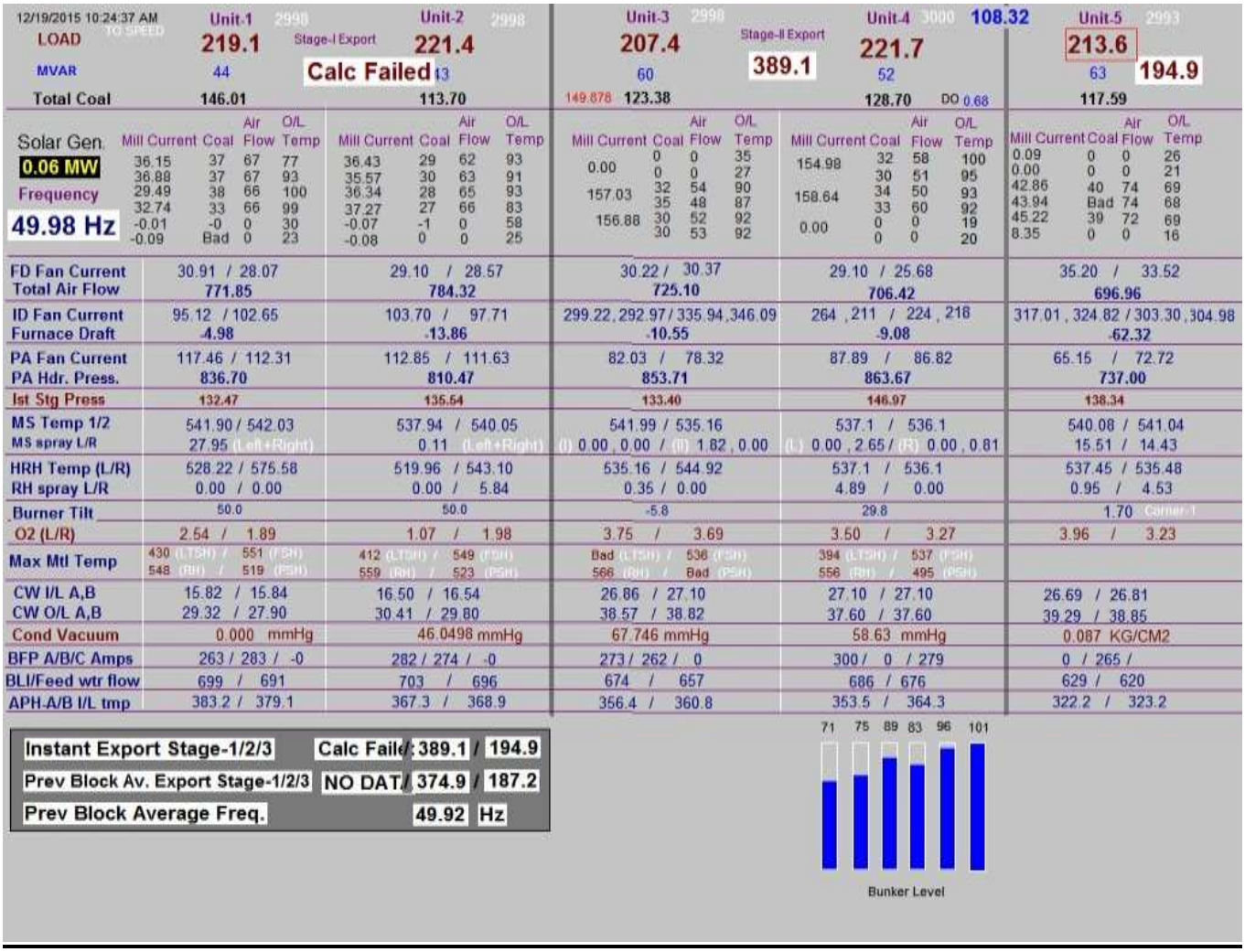


Figure 1 **Unit-1 loading after 02 months of MEJ Replacement,**
Unit-2 loading after 14 months of MEJ Replacement

6.0 Benefits of MEJ Replacement:

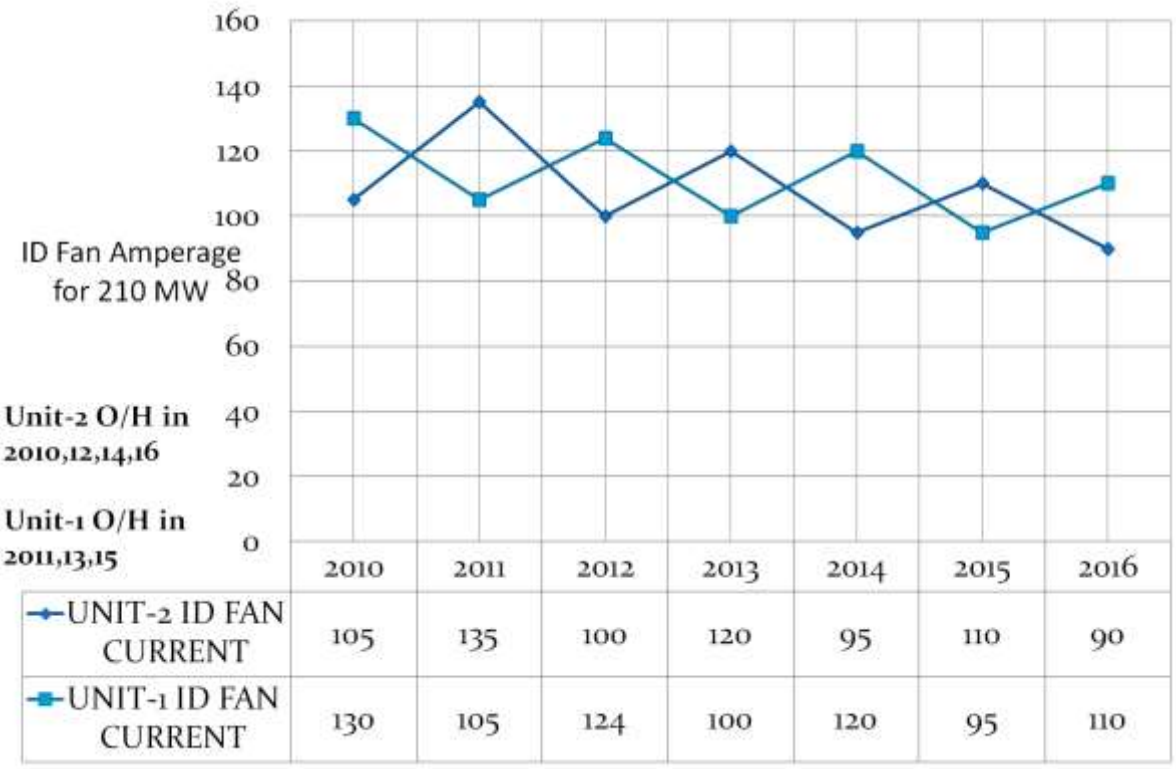
6.1 UNIT-2 PRE & POST O/H (DRAFT POWER)

DESCRIPTION	PRE O/H (27.08.2014)	POST O/H (15.11.2014)	GAIN
LOAD	219 KW	220 KW	
AIR FLOW	795	832	
FD FAN-A (KW)	228	274	-46
FD FAN-B (KW)	274	301	-27
ID FAN-A (KW)	1289	941	348
ID FAN-B (KW)	1216	887	329
PA FAN-A (KW)	1005	960	45
PA FAN-B (KW)	1024	969	55
DRAFT POWER	5038	4334	704
TOTAL GAIN (KW)	**704**		

6.2 UNIT-1 PRE & POST O/H (DRAFT POWER)

DESCRIPTION	PRE O/H (28.08.2015)	POST O/H (21.11.2015)	GAIN
LOAD	221 KW	220 KW	
AIR FLOW	800	844	
FD FAN-A (KW)	199	230	-31
FD FAN-B (KW)	176	193	-17
ID FAN-A (KW)	1491	1185	306
ID FAN-B (KW)	1328	1141	187
PA FAN-A (KW)	1205	1130	75
PA FAN-B (KW)	1210	1109	101
DRAFT POWER	5609	4988	621
TOTAL GAIN (KW)	**621**		

6.3 After replacement of Metallic Expansion joint, for 210 MW load ID fan runs in the range of 90-100 amps. whereas before replacement current was in range of 120-130 Amps.



7.0 Cost Benefit Analysis

Total expenditure of above MEJ replacement has been worked out to be Rs. 120/- Lacs only including material and service cost. Refer- ***Annexure-2.***
Payback period for the above replacement work has been worked out to be approximately 3.5 months each for both unit-2 &1.

Annexure-2

Payback period for unit-2

- *Reduction of Draft Power = 700 KW*
- *Selling Price of Electricity- Rs 4.02 per unit*
- *Saving due to APC reduction per Day*
  =700 X 24 X 4.02
  Rs. 67536/-
- *Total saving Per day - Rs.67536/-*
- *Saving per annum (@90 % PLF) – Rs 2.21 Crore*
- *Material Cost: 34 Lacs*
- *Service Cost: 30 Lacs*

Pay out Period: 0.29 years (About 3.5 Months)

Payback period for unit-1

- *Reduction of Draft Power = 621 KW*
- *Selling Price of Electricity- Rs 4.02 per unit*
- *Saving due to APC reduction per Day*
  = 621 X 24 X 4.02
  Rs. 59914.00
- *Total saving Per day - Rs. 59914/-*
- *Saving per annum (@90 % PLF) – Rs 1.96 Crore*
- *Material Cost: 17 Lacs*
- *Service Cost: 39 Lacs.*

Pay out Period: 0.28 Years. (About 3.5 Months)

Average life of Metallic Expansion joints is approximately 10 years. With this replacement work reliability of our St-I duct and draft system has been increased with annual saving of Rs. 4.10 Crores.