Performance Improvement of Boilers

Performance Improvement of Boilers

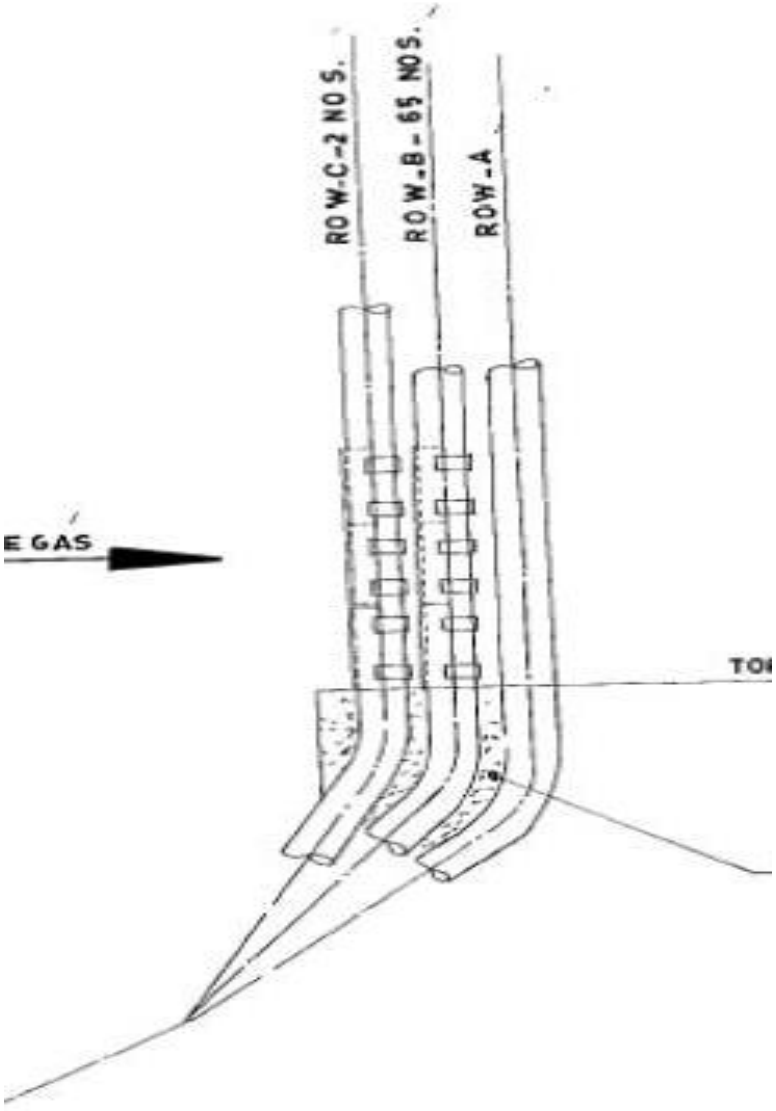
1. Higher Availability & Reliability
2. Highest Plant efficiency
3. Lower Heat Rate
4. Minimum Auxiliary Power Consumption
5. Minimum Emission of Pollutants

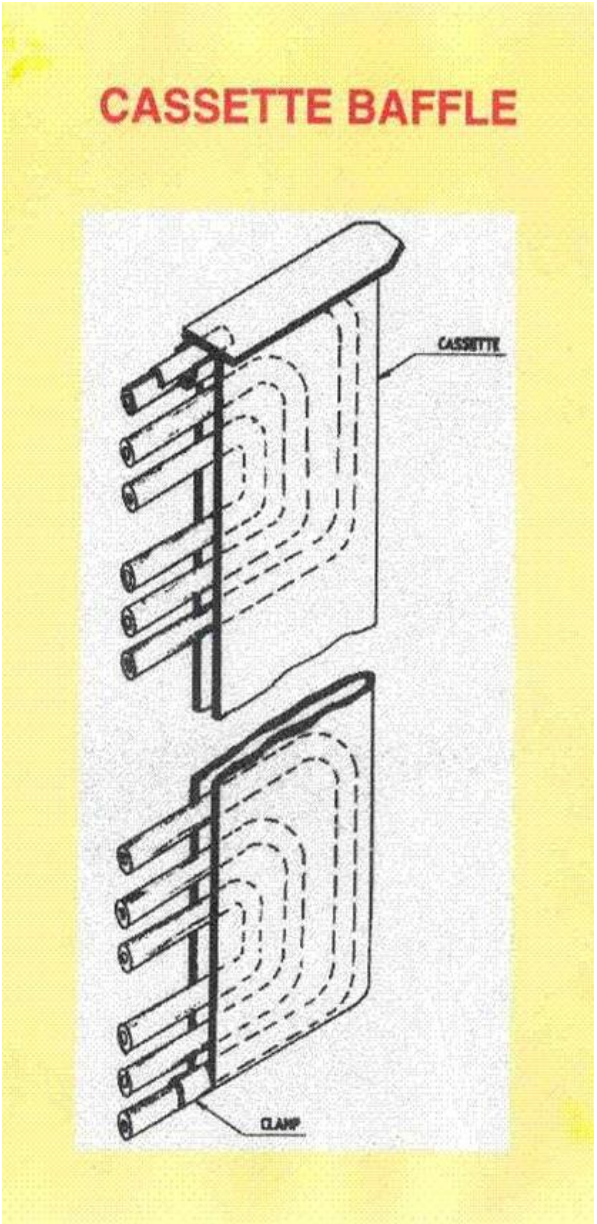
1. To increase Boiler Availability ….

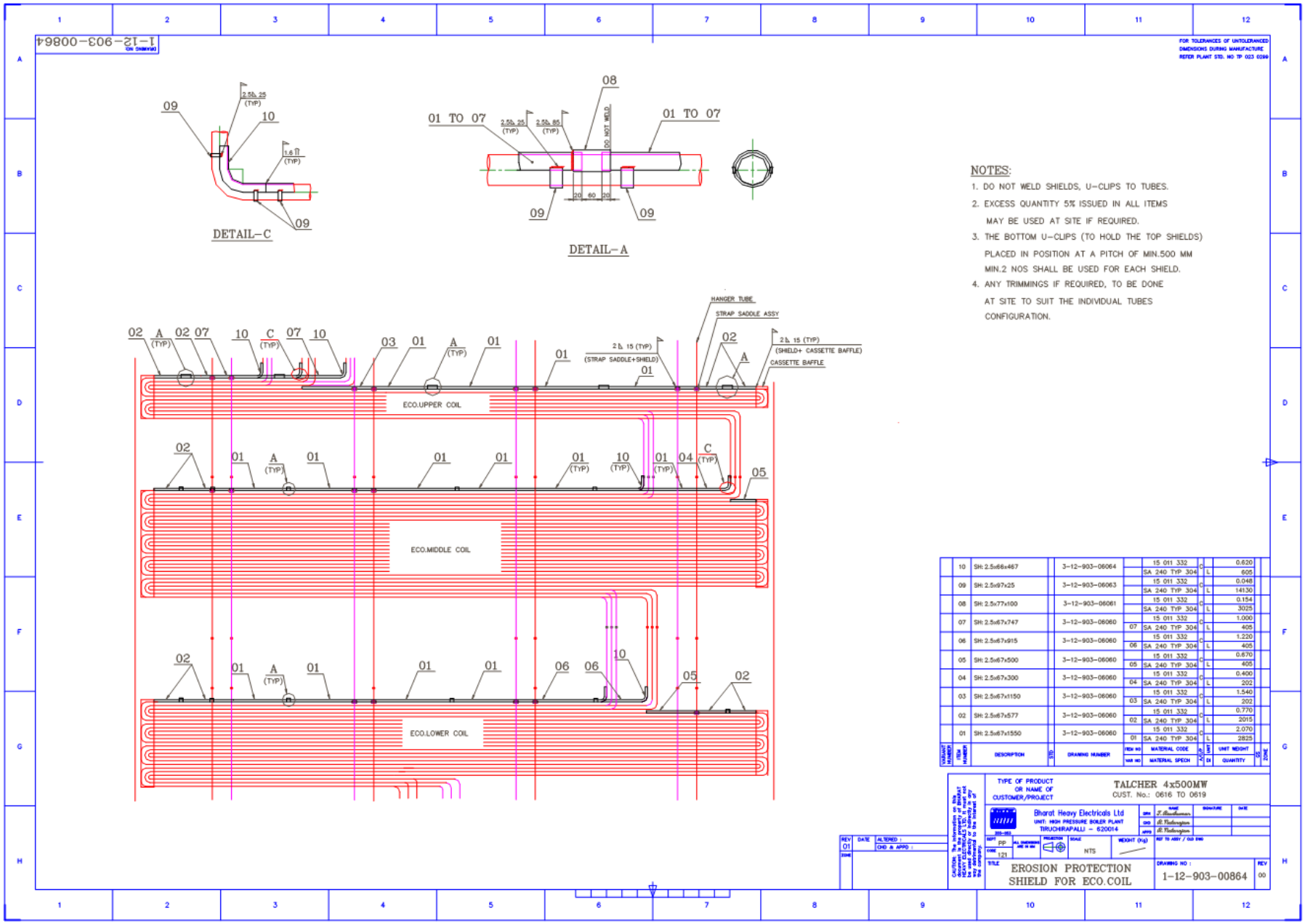
Maintain the auxiliaries

Reduce boiler tube failure

- Fatigue failure – expansion restriction / differential
- Erosion failures
- Water chemistry related problems
- Overheating failures
- Clinkering (related to coal and operating condition)


ROW.C-2 NOS.
ROW.B-65 NOS.
ROW.A
E GAS


CASSETTE BAFFLE
CASSETTE
CLAMP


1-12-903-00864
FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER PLANT STD. NO TP 023 0290
09
10
2.5h 25 (TYP)
1.6 (TYP)
09
DETAIL-C
08
01 TO 07
2.5h 25 (TYP)
2.5h 85 (TYP)
DO NOT WELD
01 TO 07
20 60 20
09
09
DETAIL-A
NOTES:
1. DO NOT WELD SHIELDS, U-CLIPS TO TUBES.
2. EXCESS QUANTITY 5% ISSUED IN ALL ITEMS MAY BE USED AT SITE IF REQUIRED.
3. THE BOTTOM U-CLIPS (TO HOLD THE TOP SHIELDS) PLACED IN POSITION AT A PITCH OF MIN.500 MM MIN.2 NOS SHALL BE USED FOR EACH SHIELD.
4. ANY TRIMMINGS IF REQUIRED, TO BE DONE AT SITE TO SUIT THE INDIVIDUAL TUBES CONFIGURATION.
HANGER TUBE
STRAP SADDLE ASSY
2h 15 (TYP)
(STRAP SADDLE+SHIELD)
2h 15 (TYP)
(SHIELD+ CASSETTE BAFFLE)
CASSETTE BAFFLE
ECO.UPPER COIL
ECO.MIDDLE COIL
ECO.LOWER COIL
10 SH: 2.5x66x467 3-12-903-06064 15 011 332 SA 240 TYP 304 0.620 605
09 SH: 2.5x97x25 3-12-903-06063 15 011 332 SA 240 TYP 304 0.048 14130
08 SH: 2.5x77x100 3-12-903-06061 15 011 332 SA 240 TYP 304 0.154 3025
07 SH: 2.5x67x747 3-12-903-06060 15 011 332 SA 240 TYP 304 1.000 405
06 SH: 2.5x67x915 3-12-903-06060 15 011 332 SA 240 TYP 304 1.220 405
05 SH: 2.5x67x500 3-12-903-06060 15 011 332 SA 240 TYP 304 0.670 405
04 SH: 2.5x67x300 3-12-903-06060 15 011 332 SA 240 TYP 304 0.400 202
03 SH: 2.5x67x1150 3-12-903-06060 15 011 332 SA 240 TYP 304 1.540 202
02 SH: 2.5x67x577 3-12-903-06060 15 011 332 SA 240 TYP 304 0.770 2015
01 SH: 2.5x67x1550 3-12-903-06060 15 011 332 SA 240 TYP 304 2.070 2825
DESCRIPTION DRAWING NUMBER MATERIAL CODE MATERIAL SPECN UNIT WEIGHT QUANTITY
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT
TALCHER 4x500MW
CUST. No.: 0616 TO 0619
Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014
DRN
CHD
APPD
SCALE NTS
WEIGHT (kg)
EROSION PROTECTION SHIELD FOR ECO.COIL
DRAWING NO : 1-12-903-00864
REV 00
REV 01 DATE ALTERED : CHD & APPD :

2. To improve Plant Efficiency ….

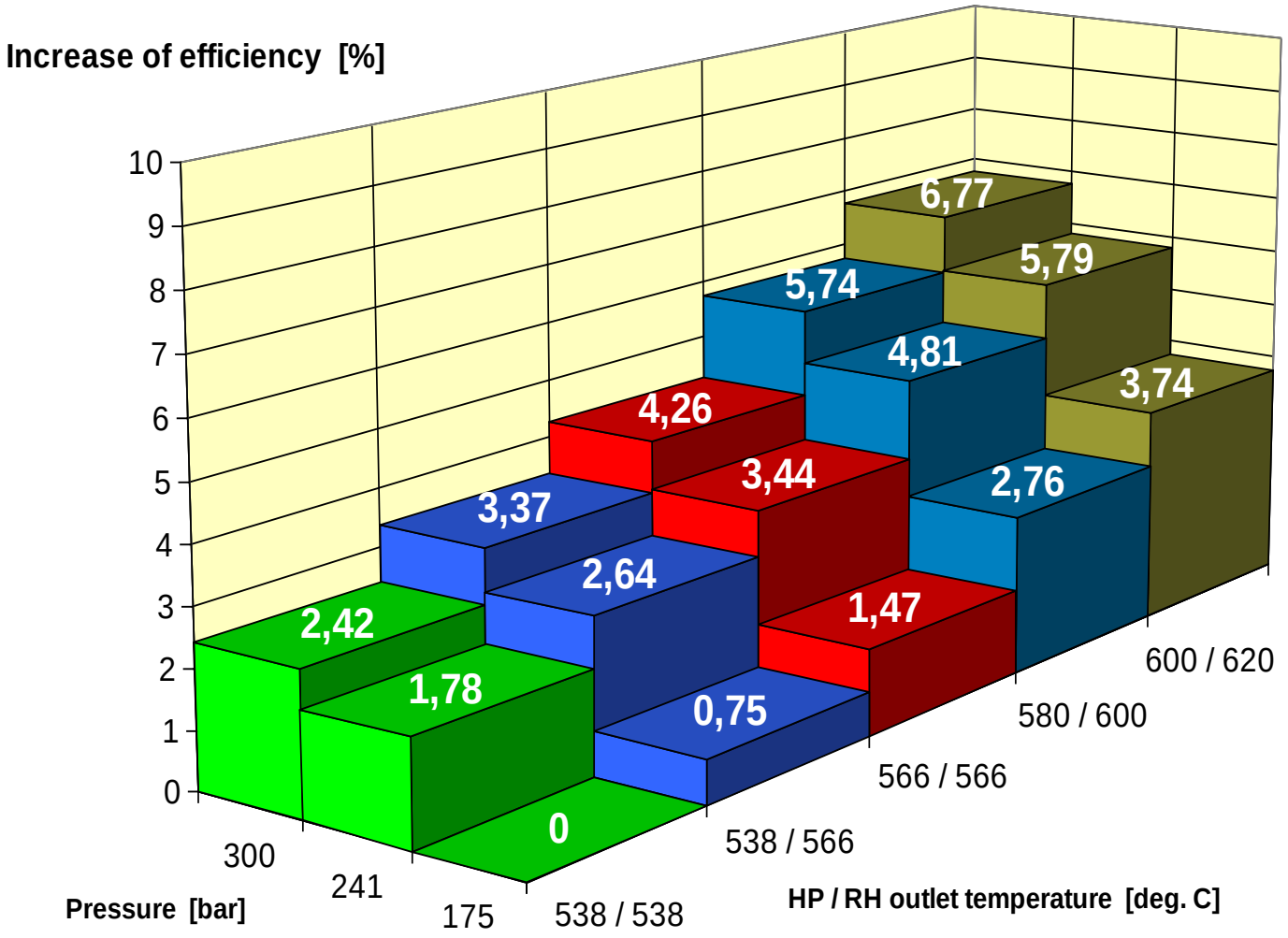
Boiler side Measures

1. Minimum flue gas temperature at AH outlet
2. Minimum excess air at AH outlet
3. Minimum un-burnt Carbon loss
4. Minimum RH spray
5. Minimum SH spray (if tapped off before feed heaters)
6. Reduced Auxiliary Power Consumption

Turbine side Measures

1. Higher steam parameters (MS Pressure & SHO/RHO Steam Temp)
2. Adoption of double Reheat cycle
3. Increasing feed water temperature with Enhanced Regenerative feed heating
4. Increase in condenser vacuum

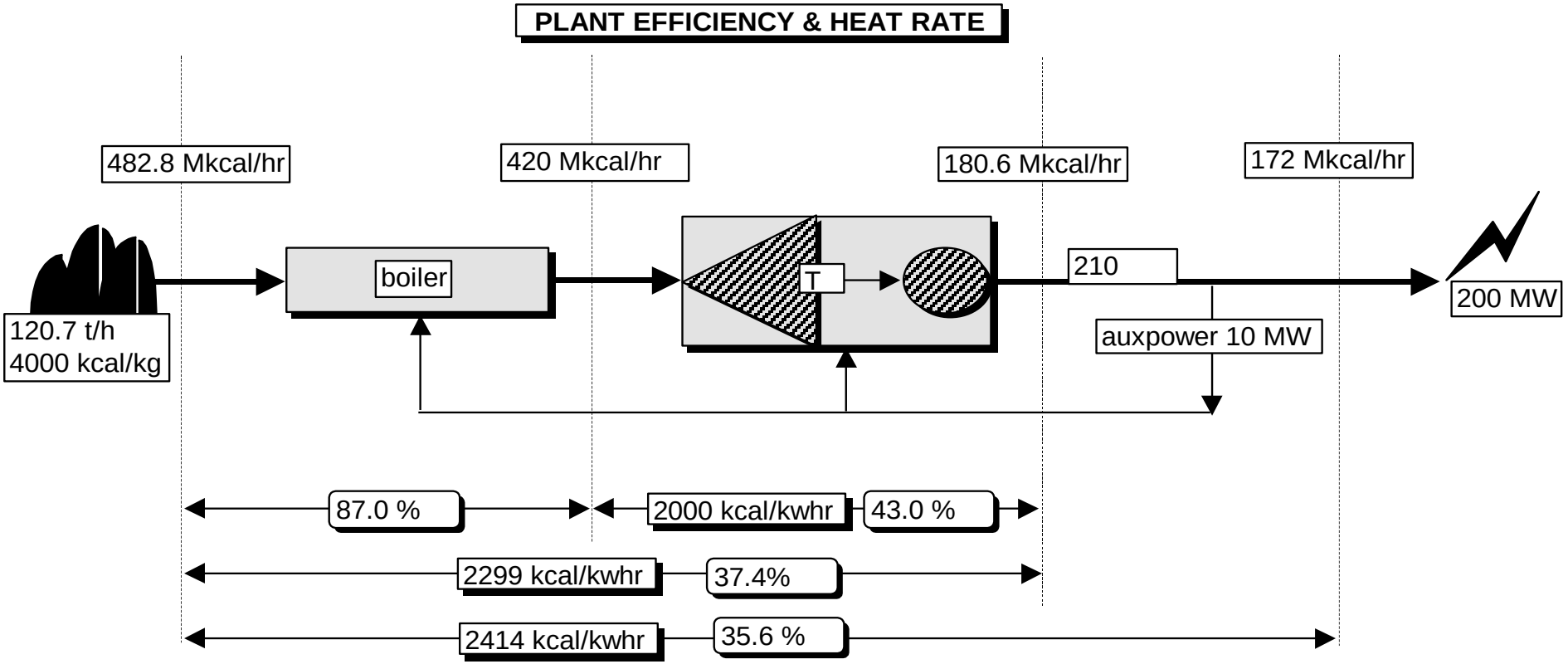
Increase of Cycle Efficiency due to Steam Parameters



3. Turbine Heat Rate ….

UNIT CAPACITY	TURBINE INLET PARAMETER	TURBINE HEAT RATE (kcal / kW hr)	STATION HEAT RATE (kcal / kW hr)
60/100MW	90 ata 535 ^{0}C	2315	2784
110/120 MW	130 ata 535/535 ^{0}C	2180	2551
200/210 MW	130 ata 535/535 ^{0}C	2025	2424
210/250 MW	150 ata 535/535 ^{0}C	1975	2335
500 MW	170 ata 535/535 ^{0}C	1950	2294
800 MW	240 ata 538/565 ^{0}C	1820	2140

Heat Rate & Efficiency



4. Reduce Auxiliary Power Consumption ….

Major reasons for increase in APC

- Operation of unit with higher excess air
- Air preheater choking & leakage
- Higher PA fan outlet pressure
- High mill fineness, more no. of mills
- Air ingress into boiler
- Plugging in line / ducting

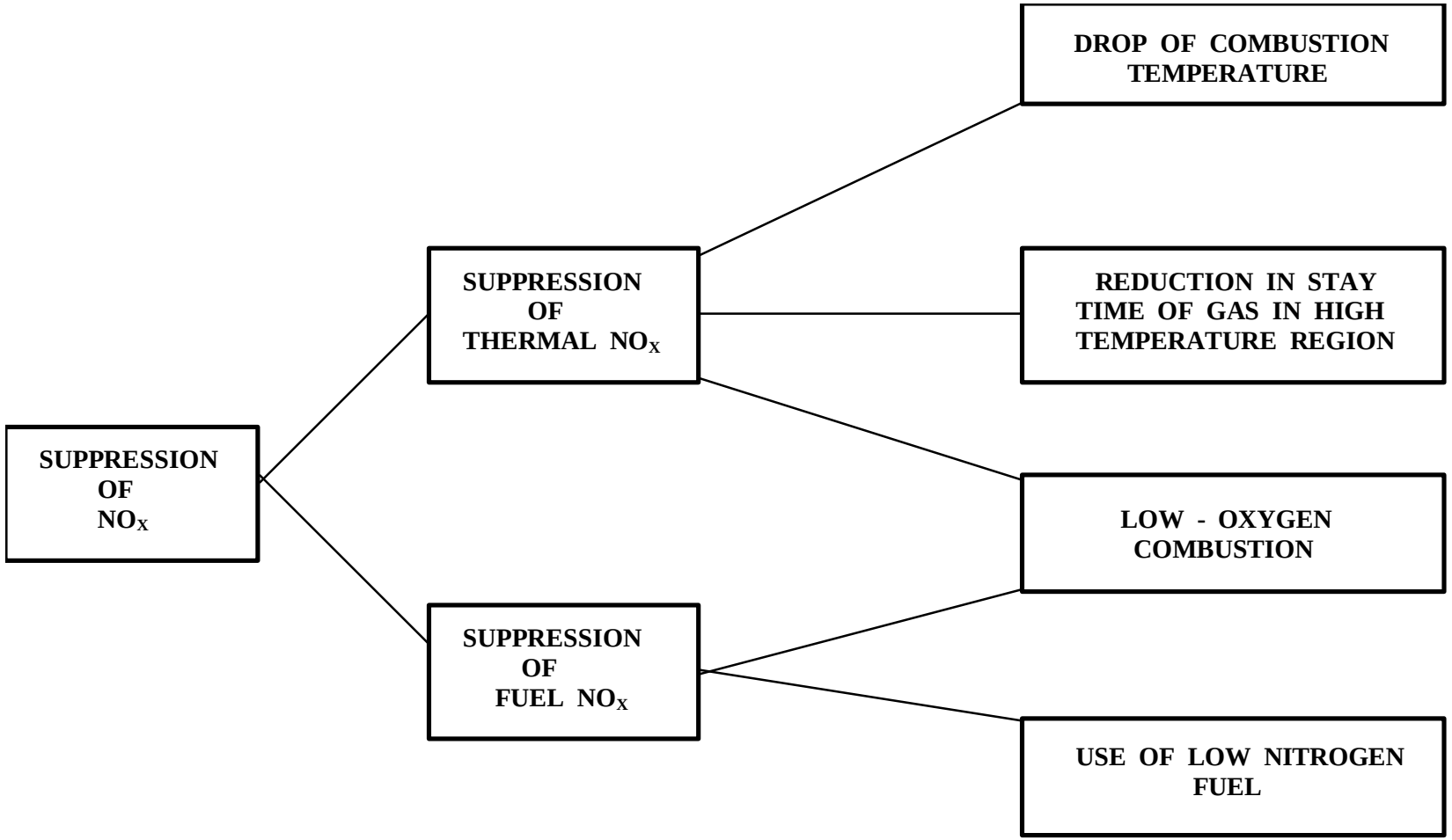
5. Minimization of Emission Levels

CEA Norms

Capacity	Pollutant	Emission
Below 210 MW		350 mg/Nm3
210 MW & above	Particulate matter (PM)	150 mg/Nm3
500 MW & above		50 mg/Nm3

NO_X Formation Mechanism

- Prompt NO_X
- Thermal NO_X
- Fuel NO_X



PRINCIPLE OF NO_X SUPPRESSION

NO_X Suppression - Combustion Based Technology

- Burner out of service (BOOS)
- Fuel biasing
- Over fire air
- Reburning
- Low excess air operation
- Flue gas recirculation (FGR)
- Low NO_X burners
- Water / steam injection

NO_X Suppression - Post Combustion Based Technology

- Urea injection
- Ammonia injection (Thermal de-NO_X)
- Conventional SCR
- Duct SCR
- Activated SCR

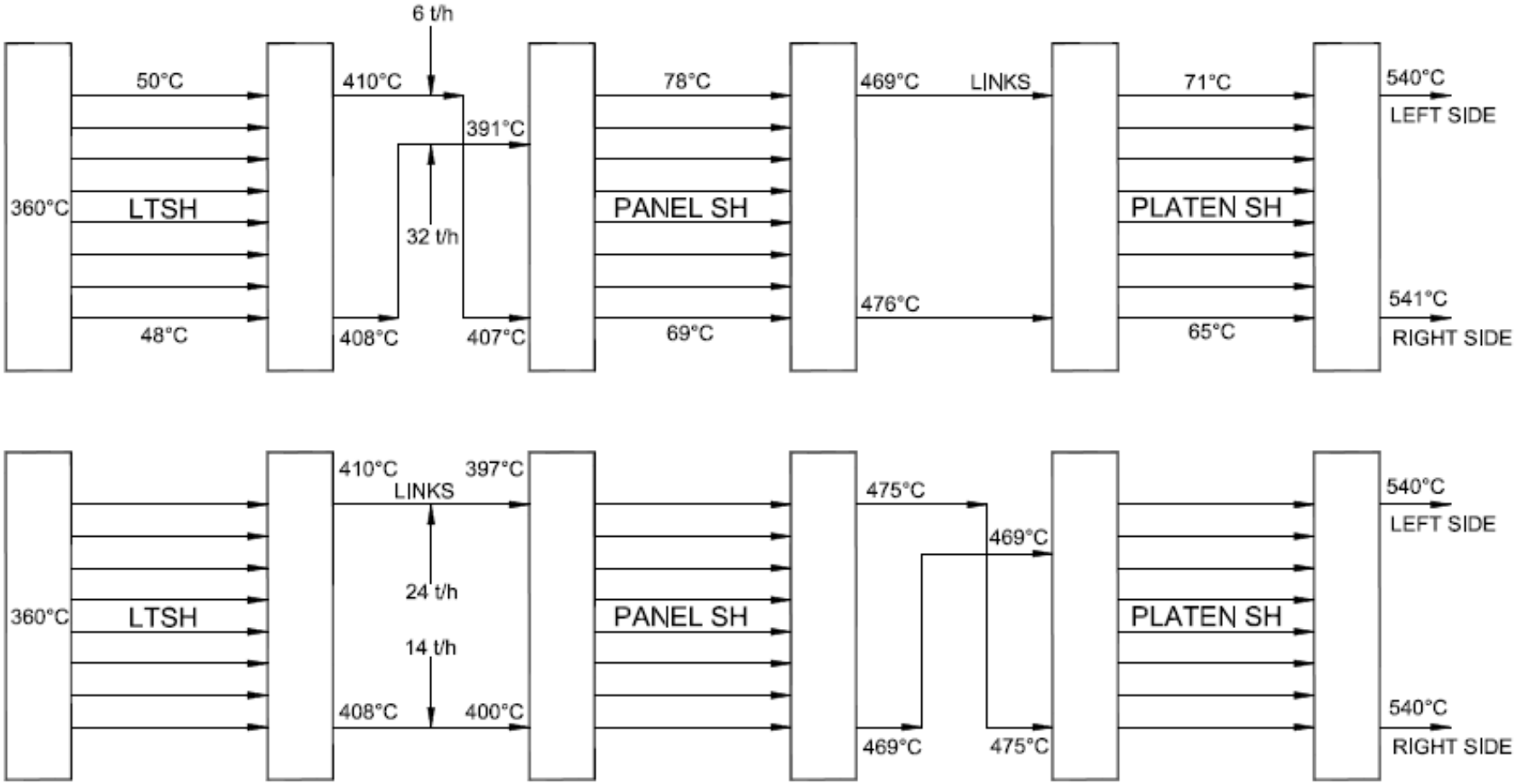
SCR : Selective Catalytic Reduction

Problems faced in 500 MW units

- Achieving the rated steam temperature in SH/RH with zero spray in RH
- Unbalance in SH/RH outlet temperature within +/-10°C
- High Metal Temperature (especially in RH)
- RH leading SH resulting in RH spray

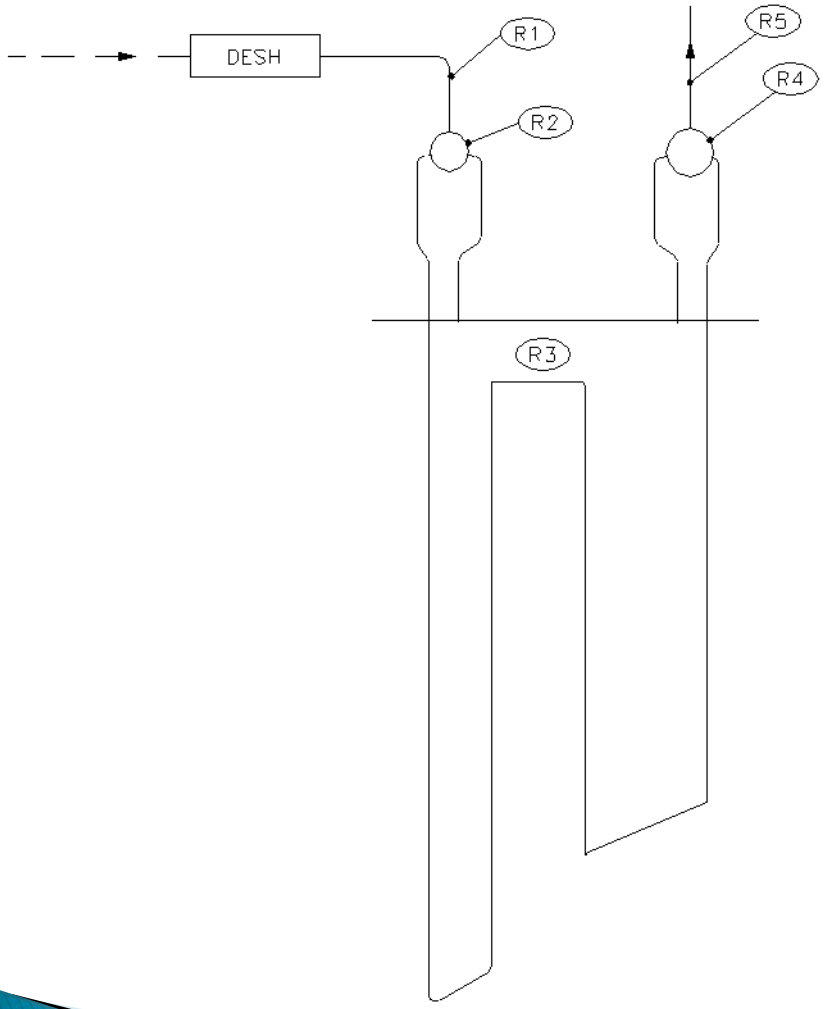
Main Steam Temperature Unbalance

Shifting of cross over links from LTSH outlet to Panel outlet to reduce the SH unbalance

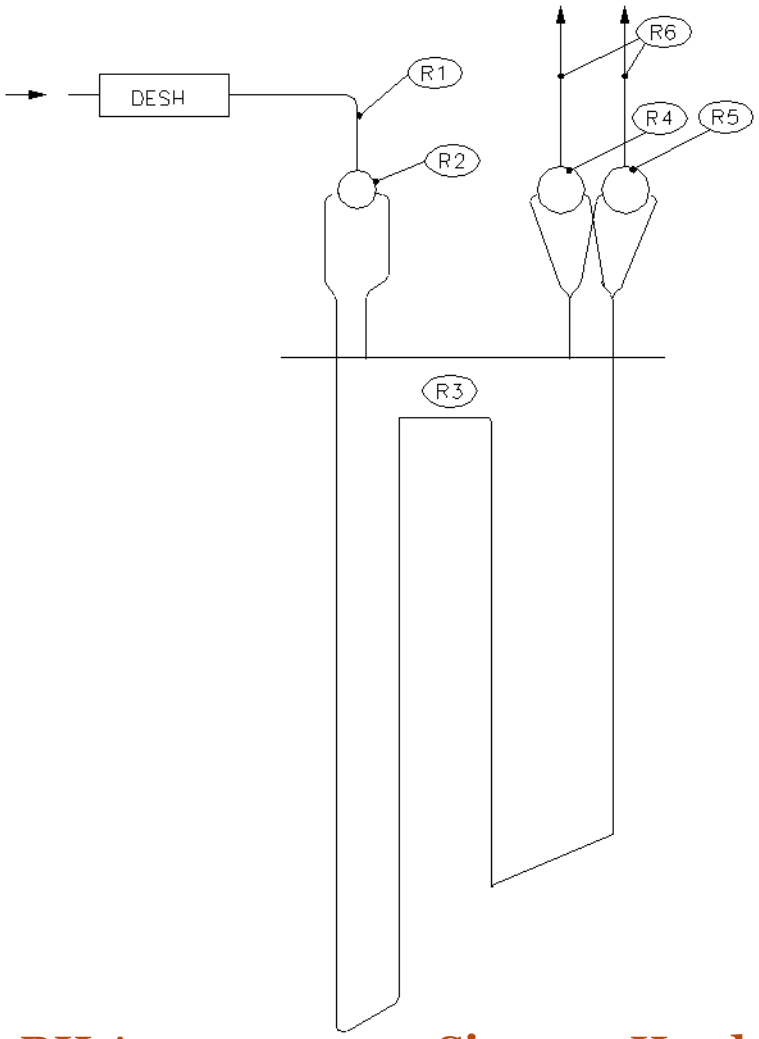


RH Temperature unbalance

Siamese header for RHO to solve the RH unbalance



RH Arrangement - Earlier



RH Arrangement - Siamese Headers

High Metal Temperature in RH

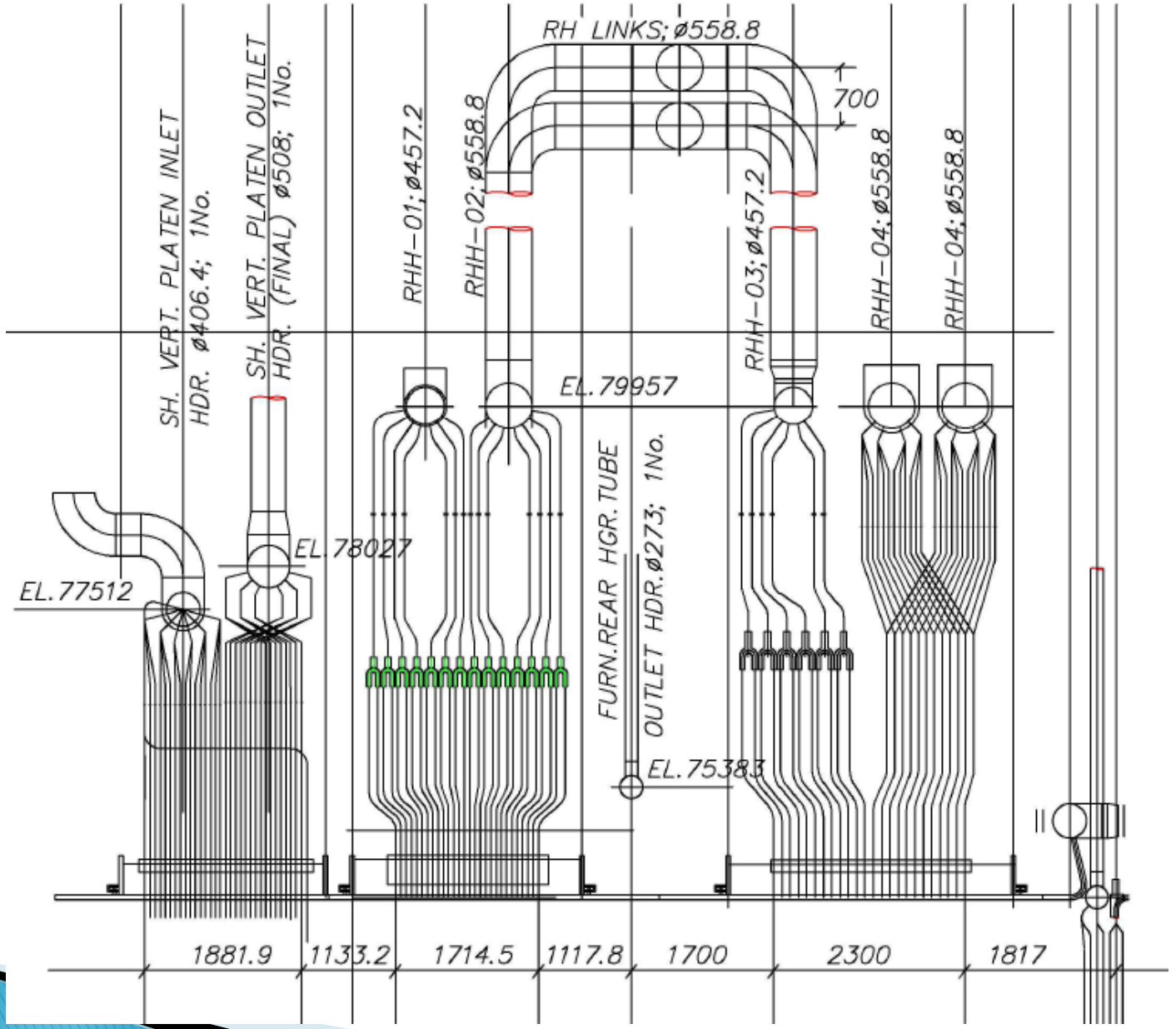
1) Upgrading the material with Stainless steel in RH rear

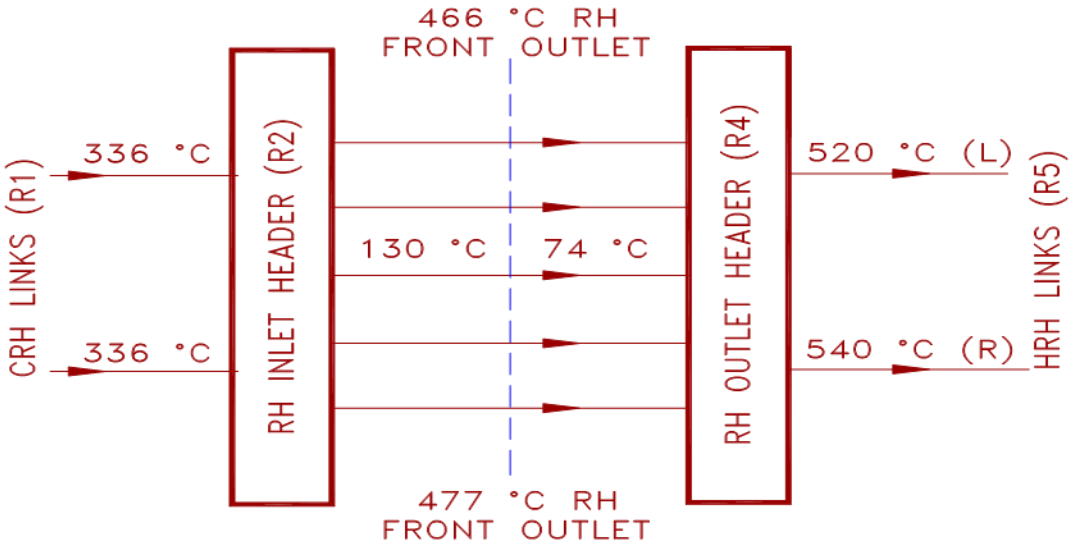
Recommended for units with 540°C RHOT

2)Splitting the existing RH into two sections with criss cross to reduce the unbalance

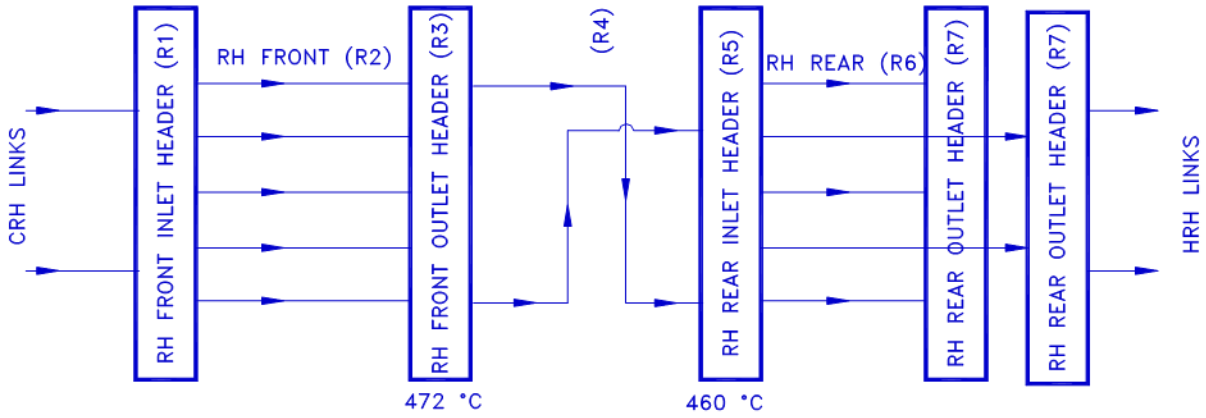
(By splitting sections, heat pickup & unbalance in each section is reduced and by crisscrossing the links overall unbalance is reduced. Pressure drop will exceed by 0.5 Kg/Sq.cm)

Recommended for units with 568°C RHOT


RH LINKS; ø558.8
700
SH. VERT. PLATEN INLET HDR. ø406.4; 1No.
SH. VERT. PLATEN OUTLET HDR. (FINAL) ø508; 1No.
RHH–01; ø457.2
RHH–02; ø558.8
RHH–03; ø457.2
RHH–04; ø558.8
RHH–04; ø558.8
EL. 79957
EL. 78027
EL. 77512
FURN. REAR HGR. TUBE OUTLET HDR. ø273; 1No.
EL. 75383
1881.9
1133.2
1714.5
1117.8
1700
2300
1817



500 MW
RH PICKUP



Expected
RH Pickup pattern
With split section