VOLUME – 2, SECTION – B

TECHNICAL SPECIFICATION
STEAM GENERATOR AND AUXILIARIES
MECHANICAL SYSTEM

For

Renovation & Modernization

of

Boiler # 1 (220 TPH) of BPSCL

Prepared and submitted by:

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BOKARO POWER SUPPLY CO. (P) LIMITED,
Boiler # 1 (220 TPH)

Subject	**Technical Specification for Steam Generator and Auxiliaries**
Client	**Bokaro Power Supply Co. (P) Ltd.** Old ADM Building Ispat Bhawan Bokaro Steel City -827 001
Consultant	**STEAG Energy Services (India) Pvt. Ltd.** A-29, Sector-16 NOIDA Uttar Pradesh 201301, INDIA
Contract Title	**Consultancy Services for R&M of Boiler # 1 to 5**
Revision No.	**03**
Contract Agreement No.	**BPSCL/CEO/P&C/09-10/C-261/84 dated 19.01.2012**
Work Order No.	**BPSCL/CEO/P&C/09-10/C-261/8449**
Project Team	
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REVISIONS

04	08.03.2017	BPSCL	BPSCL	BPSCL
03	05.06.2014	MM	RP	RP
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Revision	Date	Prepared by	Checked by	Approved by

TABLE OF CONTENTS

1.0 INTRODUCTION

INTRODUCTION

Bokaro Power Supply Company Pvt. Ltd. (**BPSCL**) established in 2001 a Joint Venture Company of Steel Authority of India Ltd.(**SAIL**) and Damodar Valley Corporation (**DVC**) and is engaged in power and steam generation and supplies power and steam (at various pressures) to SAIL's Bokaro Steel Plant (**BSL**) located at Bokaro for meeting the process requirement of **BSL**.

The **Plant has 8 boilers** (5 boilers each of 220 **TPH** and 3 boilers each of 260 **TPH** capacity) and 6 turbine generators (one 12 MW back Pressure Turbine Generator (**TG**), 2 TGs each of 55MW capacity and 3 TGs each of 60 MW capacity).

Existing Capacity

Equipment	Quantity	Specification	Capacity
BOILERS			
BOILERS (no. 1 to 5)	5	Multi-fuel Boiler	220 t/h each
BOILERS (no. 6 to 8)	3	Multi-fuel Boiler	260 t/h each
TURBINE-GENERATOR			
TURBINE-GENERATOR	1	Back Pressure Steam	12 MW
TURBINE-GENERATOR	2	Condensing Steam	55 MW each
TURBINE-GENERATOR	3	Condensing Steam	60 MW each

Date of commissioning of Boiler 1 to 5 and TG 1 to 3 are as follows:

Equipment	No. 1	No. 2	No. 3	No. 4	No. 5
Boiler	17.04.1972	14.07.1972	06.06.1974	15.07.1978	26.07.1980
TG	13.12.1974	13.07.1972	13.10.1973	-	-

The Plant is located on an area of 97 acres (approx) adjacent to BSL and has the following facilities for generation of power and steam.

BPSCL Power Plant is located in the premises of Bokaro Steel Plant **(BSL)** and has an aggregate installed capacity to generate 302MW of power besides 660 Tonne per Hour **(TPH)** of steam.

1.1 SALIENT FEATURES OF BOILER 1 TO 5

Type	T π-156
Original manufacture / Commissioned by	Krasny Kotelshik (Russia)
Rated steaming capacity t/hr	220
Working Pressure: Boiler drum, ata(g)	115
Superheater outlet ata(g)	100
Superheated steam temperature °C	540
Feed water temperature °C	215
No. of safety valves	2
Blowing capacity of each safety valve t/h	115 T/hr
Setting of drum Safety valve, ata.	124 Kg/cm^2
Setting of Super-heater safety valve, ata	105 Kg/cm^2
Drum: Internal dia x thickness, mm	1600x100
Length, mm	13940
Material, steel	22 K
Furnace size, mm	7160x9912
Furnace chamber volume, m^3	1222
Type of Air pre-heater (Total Qty - 24 Nos. each Boiler)	Tubular
Type of coal Mill	Horizontal rotating drum type
No. of Burner (Opposed firing type)	06 Nos.

WATER AND STEAM PARAMETER

TYPE	Properties	UNIT	QUANTITY
Demineralised water			
	Alkalinity	Mg/Kg	0.02
	Hardness	-	0.00
	Silica	Mg/Kg	0.03
	PH	-	6.5 - 7.2
	Ammonia	Mg/Kg	0.2
	Oxygen (O2)	Mg/Kg	0.02
	Iron (Fe)	Mg/Kg	0.03
	Conductivity	M Mho	4.00
Boiler Feed Water			
	Oxygen (O_2)	Mg/Kg	0.007
	PH	-	8 – 8.5
	Hydrazine	Mg/Kg	0.08
	Ammonia	Mg/Kg	0.3 (Max)
	Iron (Fe)	Mg/Kg	< 0.01
	Silica		
Steam			
	PH	-	8.5
	Silica	Mg/Kg	0.02

	Conductivity	μ Mho	5.00
Boiler Drum Water		**Clean Compartment**	**Salt Compartment**
	PH	8 – 9	10 – 11
	Phosphate (Mg/Kg)	10	40
	Silica (Mg/Kg)	0.01	0.04
	Conductivity (μ Mho)	100	400

The Boiler was originally designed for firing multi fuel like coal with Gross Calorific Value (GCV) in range of 4500 - 5000 kcal/kg , Blast furnace (BF) and Coke Oven (CO) gas. At present the unit operates on coal with GCV in the range of 3800 kcal/kg to 4300 kcal/kg. Due to aging problem and uncertainty in the continuous supply of BF and CO gas the generation has reduced drastically. The performance data indicates that the output from these Units has been declining and it is now operating well below its original designed performance rating. In view of the above condition there is a steady decline in the boiler efficiency.

The fact that the unit was commissioned well over 30 years ago made it necessary to evaluate the condition of the different sub-systems. This permitted a realistic assessment on whether there is need to replace or repair/modify in order to achieve higher efficiency output and reliability sustainable over the next 20 years at least. The assessment also provides the basis for a realistic estimation of costs and benefits in order to present a proposal for the renovation and modernization of the unit.

Bidder should access the condition of the boiler by site visit and do necessary testing and inspection for the retainable portion of the boiler. The bidder is allowed to check the available assessment report, Energy Audit Report, etc. for his satisfaction prior to submission of his offer.

As a part of R & M activity, Steam Generator technical specifications are prepared for retrofitting, keeping in view changes in existing equipment and civil foundations. The objectives of R&M work of Steam Generator & Auxiliaries are as below:

a) Retaining steam generating capacity of minimum 176 TPH with design coal only (CV 3800 kCal/kg) & minimum 210 TPH with coal + gas (BFG @ 50,000 Nm^3/hr + COG @ 3,000 Nm^3/hr respectively).
b) Extending unit life by 20 years of reliable operation.
c) In this regard technical specification of steam generator is arrived in detail in the following sections.

1.2 FACTORS GOVERNING SCOPE

In the present condition, it is not possible to operate these units to its original design parameters at rated capacity without major renovation.

Only proven options for retrofit, which are site-specific to, the requirements of BPSCL, are considered.

In general, the goal is aimed at retaining the unit generation capacity of minimum 176 TPH with coal firing and to extend its life by 20 years of reliable operation.

The optimized scope is governed by the following:

1. Replacement of components, which have exhausted their life.
2. Replacement of components for which spare parts will not be available in future.
3. Repair of parts, which could be retained service without compromising reliability and safety.

4. Change of components that are needed to adhere to prescribed environmental standards.
5. Necessary modifications in the system to run the unit at rated capacity with the available low calorific coals.
6. Obsolete technology.

The specification has compiled measures specific to unit 1 of BPSCL that are considered as the **Essential Scope**.

1.3 ABBREVIATIONS

- **ABT** - Availability Based Tariff
- **APH** - Air Pre heater
- **ASME** - American Society of Mechanical Engineers
- **ASTM** - American Society For Testing & Material
- **BFP** - Boiler Feed Pump
- **BFG** - Blast Furnace Gas
- **BMCR** - Boiler Maximum Continuous Rating
- **BTG** - Boiler-Turbine Generator
- **C & I** - Control & Instrumentation
- **CFD** - Computerized Fluid Dynamics
- **COG** - Coke Oven Gas
- **DC** - Direct Current
- **EJMA** - Expansion Joint Manufacturers Association
- **EMCR** - Economic Maximum Continuous Rating (with 3% make up)
- **EPRS** - Effective Projected Radiant Surface
- **ERW** - Electric Resistance Welded
- **FCNRV** - Feed Control Non Return Valve
- **FD** - Forced Draught
- **FRLS** - Fire Retardant Low Smoke
- **GCV** - Gross Calorific Value
- **HFO** - Heavy Fuel Oil
- **HGI** - Hard Groove Index
- **HP** - High Pressure
- **HT** - High Tension
- **IBR** - Indian Boiler Regulations
- **ID** - Induced Draught
- **LDO** - Light Diesel Oil
- **LP** - Low Pressure
- **LRSB** - Long Retractable Soot blower
- **MCC** - Motor Control Centre
- **NB** - Nominal Bore
- **NWL** - Normal Water Level
- **NDT** - Non-Destructive Testing
- **PC** - Pulverized Coal
- **PCF** - Pulverized Coal Feeder
- **PF** - Pulverized Fuel
- **PTFE** - Poly-Tetra-Fluro-Ethylene
- **RC** - Raw Coal
- **RCF** - Raw Coal Feeder
- **RTD** - Resistance Temperature Detector
- **RLA** - Residual Life Assessment
- **RMT** - Running Meters
- **SH** - Super heater

- **SPM** - Suspended Particulate Matter
- **SS** - Stainless Steel
- **SWG** - Standard Wire Gauge
- **TDS** - Total Dissolved Solid
- **TEFC** - Totally Enclosed Fan Cooled
- **TMCR** - Turbine Maximum Continuous Rating
- **VVD** - Variable Voltage Drive
- **VWO** - Valve Wide Open
- **WB** - Wall Blowers
- **XLPE** - Cross Linked Poly Ethylene

2.0 INTENT OF SPECIFICATION

2.1 INTENT OF SPECIFICATION FOR BOILER

This specification pertaining to the R&M of BPSCL Unit 1 (220 TPH) Steam Generator and Auxiliaries is intended to cover the scope of work for rehabilitation of the Steam Generator so as to make it capable of producing the steam at desired parameters. The existing steam generator design is based on the use of coal with high calorific value as well as BF and CO gas. At present the available coal is of lower calorific value and there is uncertainty in continuous availability of BF and CO gas from steel plant. The bidder is expected to re-engineer the steam generator to give the guaranteed output and performance with the use of coal as primary fuel and BF and CO gas as secondary fuel, which is specified in clause no..3.1.4. The existing steam generator has operated for over 30 years and its performance has degraded on all fronts especially on account of inadequate supply of coal of designed GCV , BF and CO gas from steel plant and general deterioration in water-wall, super-heaters, economizer, air pre-heaters, oil & coal burners, valves & ducts etc. of boiler. The bidder is expected to renovate the boiler by adopting latest development and improved metallurgy options for boiler components so that it is able to operate and give satisfactory and reliable performance for further period of 20 years with high availability and improved efficiency.

2.1.1 The boiler design is to be upgraded by replacing existing burners with separate / coaxial burners for coal & gas, to give flue gas temperature between 384 °C and 395 °C at inlet to Air-preheater top block. The renovated boiler shall be capable of feeding steam not less than 176 TPH (firing coal of GCV 3800 kCal/kg) & not less than 210 TPH at rated parameter when firing both coal and gas.

2.1.2 The specification has described the scope of work and endeavored to cover all the major equipment and related activities and work necessary for repair/ replacement/ retrofit. However any other minor item/service which has not been specifically mentioned but is required for the completeness of the work shall also be supplied by the contractor. The bidder is therefore advised to visit the site and acquaint himself with the condition of the plant and equipment to enable him to make assessment of the complete job.

2.1.3 The objective of specified R&M work of Steam Generator and Auxiliaries is as below:
a) Enhance the operating life of the steam generator by 20 years.
b) Modernize Steam generator control system on PLC / DDCMIS platform.

2.2 GENERAL DESCRIPTION OF EXISTING STEAM GENERATOR

The Boiler supplied by M/S Krasny Kotelshik (Russia) for BPSCL Boiler 1 to 5 is of Conventional, Single Drum, Natural Circulation, Balanced Draft, Opposed Fired, Dry Bottom Type. The furnace walls, super heaters and the economizers are self-contained assemblies and are suspended from a supporting structure. Furnace oil as well as gas can be used as fuel for preheating during start up and to provide combustion stability at low loads.

The steam generator has two enclosures:

a) The furnace or Radiant Zone.
b) The rear pass or Convection Zone.

The schematic for the steam generator is shown in Annexure I.

2.2.1 The boiler furnace is opposite fired at 1 elevation with 6 nos. coaxial burners firing coal supported by gas and oil burners.. The design specifications of boiler furnace are indicated below.

Width : 9912 mm
Depth : 7160 mm
Volume : 1222 cubic meters
Type : Bare Tube Construction

2.2.2 The Super heater system consists of First pass Ceiling Superheater, Screen Superheater, Second pass Ceiling Superheater, Convective I Superheater and Convective II Superheater mentioned in the order of steam flow. The location of these Super heaters with reference to the gas flow direction will be in the order of Screen Super heater, Convective I Super heater and then Convective Super heater. The SH spray has been provided between Convective II and Convective I in steam flow direction. The heating surface areas of super heaters are indicated below. Their sizes are given below:

Ceiling Super Heater : 220 square meters
Screen Super Heater : 705 square meters
Convective Super Heater : 1870 square meters

2.2.3 The Superheater Steam Temperature Control under part load condition is ensured by Desuperheaters or Spray Control System. There is only one stage of Desuperheating located in between the Convective I Superheater and Convective II Superheater.

2.2.4 The steam Temperature Control for Superheater system thus ensures the rated temperature of 540°C at Convective II Superheater outlet

2.3 ECONOMISER

The economizer is of continuous loop, drainable horizontal, alternate straight and staggered coil arrangement, arranged in two banks as upper and central block over APH II and lower block is located between APH I and APH II with water flow upwards and gas flow downwards. The design specification of the Economizer include-

Type	:	Continuous Seamless
Heating Area	:	2195 square meters
Number of banks	:	2 (Two) Arrangement: Alternate Inline and Staggered arrangement
Nos. of coils in upper & central block	:	29 coils @ 132 pitch (11 bends per coil)
Dimension	:	Φ32 mm x 3.5 mm thick
Nos. of coils in lower block	:	26 coils @ 110 pitch (6 bends per coil)
Dimension	:	Φ32 mm x 3.5 mm thick

Sr. No.	Location	Material of Construction (Russian Type)
1	Economizer	SA 209T1,T11
2	Waterwalls	SA 210GrC
3	Downcommers and steam outlet tubes	CT20
4	Ceiling Superheaters	SA 209T1
5	Screen Superheaters	12XIMP Φ, SS347H
6	Convective I Superheater	12XIMP Φ

7	Convective II Superheater	12XIMP Φ
8	Steam bypass tubes	12XIMP Φ
9	Superheater blowdown tubes	12XIMP Φ
10	Outlet tubes from economizer to drums	CT20
11	Feed pipes	CT20

Note:

i. Material composition of 12XIMPΦ are 0.12% C, 1% Cr, 0.3% Mo, 0.20% V (Temperature limit up to 595°C)
ii. Material composition of CT 20 are 0.20% C, 0.17 – 0.37% Si, 0.35 – 0.65% Mn, 0.25% Cr (Temperature limit up to 450°C)

2.4 AIR HEATER

Air Heater is tubular type and there are one APH with flue gas through tubes and air outside. The design specification of the Air Heater include-

Type : Tubular type
Heating area : 16260 square meters
Numbers : 1

2.5 FUEL BURNING EQUIPMENTS

The primary fuel for the plant is BF, CO gas and coal with furnace oil for startup. The burner is of co axial type capable to fire all fuels. The design specification of Fuel Burning Equipments include-

Burner

Type	:	Wall fired Burners	
Number of Main Burners	:	6	
Number of Oil Burners	:	6	
Capacity – main burners	:	Pulverized Coal	8 TPH
		BF Gas	16000 m^3/hr
		CO Gas	3000 m^3/hr
		Furnace Oil	500 Kg/hr

2.6 MILLS AND FIRING SYSTEM

The pulverized fuel system adopted for BPSCL boilers 1 to 5 employs a drum type ball mill with the indirect firing utilizing hot air as a drying-cum-transporting medium. The ball and tube mill is of suction type with coal input from RC feeder and hot air from one side dry and lifts the pulverized coal to the separator from where oversized particle are sent back to pulverizer. The coal dust collected in the cyclone is transported to the coal dust bunker by screw conveyor. The mill fan takes the suction air from the cyclone and pressurizes the coal dust collected in the coal dust bunker through blade type dust feeder to the furnace. The schematic for the milling system is attached in Annexure II.

The Existing Milling plant details are as below:

Raw Coal Bunker

Number of bunker per boiler	2
Bunker volume (m^2)	270
Raw Coal Feeders	
Number of feeder per boiler	2
Type	CY 700/5040T
Rates output (t/h)	30/32.6
Speed of feeder (m/sec)	-
Motor rating (KW)	14
Motor speed (rpm)	500/1500
Motor rated voltage (V)	415
Drum type Ball Mills	
Number of mills per boiler	2
Type	W5M 287X470
Rated output (tph)	16
Drum rotation speed (rpm)	18.7
Drum dia. X length (mm)	2870 x 4700
Weight of balls (tons)	35
Diameter of balls (mm)	40
Hardness of balls (BHN)	300
Motor rating (KW)	570
Motor speed (rpm)	745
Motor rated voltage (V)	6600
Dust Separator	
Number of units per boiler	2
Diameter (mm)	3300
Collecting Cyclone	
Number of units per boiler	2
Diameter (mm)	2350
Screw Conveyor	
Diameter (mm)	500
Length (m)	96
Capacity (TPH)	45
Motor rating (KW)	40
Motor speed (rpm)	1000
Motor rated voltage (V)	415
Blade Type Dust Feeders	
Number of feeders per boiler	6
Maximum capacity of coal (TPH)	8
Maximum capacity of pulverized fuel coal (TPH)	2.66
Number of outlet branches	2
Dimensions of inlet port (mm)	800 x 800
Diameter of outlet port (mm)	115

Reducing gear ratio	49
Blade height (mm)	38
Weight of one feeder with motor (kg)	1475
Motor rating (KW)	3.4
Motor speed (rpm)	500 – 1500
Motor rated voltage (V)	220 DC
Coal Dust Bunkers	
Number of bunkers per boiler	2
Capacity of each bunker (T)	90 – 100
Volume of each bunker (m^3)	125
Ball Mill Lubrication Pumps	
Number of systems	2
No. of rotary gear pumps per system	2
Capacity (l/min)	50
Pressure (kg/cm2)	10 – 13
Motor rating (KW)	3
Motor speed (rpm)	1480
Motor rated voltage (V)	415
Discharge oil filter capacity (micron)	25
Flow rate (l/min)	100
Two nos. oil tank capacity (m^3)	1.2 / 2.0

The existing design fuel characteristics are as below:

Middling Coal Properties	
Fixed carbon	27 – 30 %
Volatile matter	22 – 25 %
Moisture	1 – 3 %
Ash	35 – 40 %
Ash fusion temperature	1350 – 1400 °C
CV	4500 - 5000 Kcal/kg
BF Gas Characteristics	
CO	22 to 25% by volume
H_2	3.5 to 4% by volume
O_2	0.2 to 0.3% by volume
N_2	53 to 57% by volume
CO_2	18 to 20% by volume
CV	850 kCal/m^3
Specific Gravity	1.3 kg/m^3
Self-Ignition Temperature	680 °C
Explosiveness with Air:	
Lower Limit	37%

Upper Limit	71%
CO Gas Characteristics	
CO	6.0 to 7.5% by volume
H_2	54.0 to 60.0% by volume
CH_4	23.0 to 26.0% by volume
Unsaturated Hydrocarbon	2.0 to 3.0% by volume
O_2	0.6 to 0.8% by volume
Naphthalene	200 to 350 mg/Nm^3
Tar Fog	40 to 60 mg/Nm^3
NH_3	60 to 100 mg/Nm^3
H_2S	1200 to 1500 mg/Nm^3
CV	4200 kCal/m^3
Specific Gravity	0.45 kg/m^3
Self-Ignition Temperature	560 °C
Explosiveness with Air:	
Lower Limit	5.6%
Upper Limit	34.7%
Fuel Oil Analysis	
Grade	LV and HV oil
Specification	IS-1593-1960
Kinematic viscosity at 50°C (Centistokes/Redwood seconds)	80 (LV) 370 / 1500 max (HV)
Flash point PM °C (Pensky-Martens Closed Cup method)	66
Water content (% vol)	1.0 max
Sediments (% wt)	0.25 max
Ash (%wt)	0.10 max
Sulphur total (%wt)	3.5 max
GCV (kcal/kg)	10000±1.2 %
Acidity inorganic	NIL
Specific gravity at 15°C	0.90

2.7 FANS

Two numbers of Forced Draft and Induced Draft fans per boiler are used for maintaining draft in the furnace. The Mill Fan is used in indirect firing for sending the coal into the furnace. The design specifications of fans include-

2.7.1 Forced Draft

Type	:	BDH/18-11
Make	:	Russian
Number per Boiler	:	2
Capacity at 30°C	:	112300 cubic meters / hr.
Pressure	:	440 mm water column

Rating	:	220 KW
Speed	:	980 rpm

Induced Draft

Type	:	Double Suction, D-21.5X2
Make	:	Russian
Number per Boiler	:	2
Capacity	:	199000 cubic meters / hr.
Pressure	:	290 mm water column
Temperature For flue gas	:	200°C
Rating	:	400 KW
Speed	:	580 rpm

2.7.2 Mill Fan

Type	:	Bm 50/1000-16
Make	:	Russian
Number per Boiler	:	2
Capacity	:	53500 cubic meters / hr.
Pressure	:	1050 mm water column
Temperature	:	300 °C max.
Rating	:	300 KW
Speed	:	1450 rpm

2.7.3 Soot Blowers

The design specifications of Soot Blowers include-

Located at Water Walls

Type	:	Wall Blowers
Number per Boiler	:	18

2.8 INSULATION & REFRACTORY

The boiler has necessary lining and insulation along with fixing material to limit the outside surface temperature to the required level.

The complete integral piping, valves and fittings, all air and gas ducting with dampers/ gates and necessary refractory materials are also provided.

2.9 ESP

ESP Type	:	FAA – 4 x 52.5H – 69 – 135 – A2
Gas flow, m^3/sec	:	155.5
Gas temperature, deg C	:	170
Maximum temperature, deg C	:	220
Pressure drop across ESP, mm.Wg.	:	22
Inlet dust concentration, gm/Nm^3	:	50 - for coal only 35 - for mixed fuel
Outlet dust concentration, mg/Nm^3	:	150 - for coal & mixed fuel
ESP collection efficiency, %	:	99.7 - for coal only 99.572 - for mixed fuel
Effective migration velocity, m/sec	:	6.548 - For coal only 7.683 - for mixed fuel
No. of ESPs per boiler	:	2
No. of fields per ESP	:	4
T / R Panel rating	:	70 KV / 1000 mA

2.10 CODES & REGULATION

2.10.1 Pressure Parts

The pressure parts of the main Boiler sections identified for up-rating in this Proposal will be modified / designed in accordance with the latest applicable Indian Boiler Regulation or other acceptable international codes whichever is superior. The materials used will be in accordance with ASTM Standards.

The manufacture of the equipment and the erection at the Site will be done as per Indian Boiler Regulation Codes.

The shop and erection inspection will be carried out as per Indian Boiler Regulations.

2.10.2 Non-Pressure Parts

For the non-pressure parts identified for modification, all materials used will conform to various Indian Standards or equivalent International Standards.

2.11 DESIGN PARAMETERS

The design parameters of the boiler are as below:

Main steam Flow at Convective II SH outlet	220t/hr
Main steam Temperature at Convective II SH outlet	540ºC
Main steam Pressure at Convective II SH outlet	100 atag
Feed water Temperature at Eco Inlet	215ºC
Number of safety valves	2
Blowing capacity of each safety valves	115 tph
Set pressure for drum safety valve	124 ata
Set pressure for superheater safety valve	105 ata

2.12 PAST HISTORY

Boiler Tube Leakages (Area wise)

a) Incidences of tube failures

Unit 1 to 5 from August 2010 – 2011								
Year	**WATER WALL**	**ECONOMISER**	**Super Heater**	**Ceiling Super Heater**	**Screen Super Heater**	**Feed line**	**PBD Bend**	**Sub-Total**
Unit I	1	1	2	-	-	-	1	**5**
Unit II	-	2	1	-	-	-	-	**3**
Unit III	1	1	1	-	1	1	-	**5**
Unit IV	-	2	1	1	-	-	-	**4**
Unit V	1	6	1	-	-	-	-	**8**
Total	**3**	**12**	**6**	**1**	**1**	**1**	**1**	**25**

b) Number of Forced outages month wise from August 2010 – 2011

Unit	**U-1**	**U-2**	**U-3**	**U-4**	**U-5**
AUG	-	-	2	1	2

Unit	U-1	U-2	U-3	U-4	U-5
SEP	-	1	-	-	-
OCT	-	-	-	-	1
NOV	-	-	-	-	1
DEC	1	1	-	1	-
JAN	-	1	1	1	1
FEB	2	-	-	1	-
MAR	2	1	1	1	-
APR	-	1	1	-	1
MAY	-	1	2	1	-
JUNE	2	2	1	-	2
JULY	1	-	2	-	2
AUG	-	-	-	-	1
Total	**8**	**8**	**10**	**6**	**11**
Total Outage Hours	**408**	**1141**	**562**	**613**	**713**

c) Historical catalogue of major works carried out for different Unit

i. RLA study has been done for Unit No # 4 by M/S ALSTOM on 2008
ii. Roof structures partially changed.
iii. Central column of boiler 2 changed
iv. APH blocks of Boiler 2, 3 ,4 changed.
v. Ceiling SH of Boiler 2 changed.

Note: In addition to that following modifications were carried out by M/S BHEL for all the 5 units in 90's:

i. The panels for Convective I and II super-heaters were changed with different material.
ii. Eight (8) numbers of Screen superheater panels and ceiling SH were changed.
iii. All Economizer panels were changed.
iv. Water walls and header changed partially.

d) Deviations in operating parameters of BOILER Unit#1 to 5

Description	**Unit**	**Design/Max.**	**U#1**	**U#2**	**U#3**	**U#4**	**U#5**
Steam Generation	TPH	220	125	135	125	145	200
GCV	kcal/kg	4500-5000	3947	3947	3947	3947	3947
Condensate Injection (L/R)	TPH		-	-	-	-	-
Drum Pressure	ksc	110	86	87	89	88	88
Water & Steam Parameters							
Main steam flow	t/h		125	135	125	145	200
Main steam temperature	°C	540	527	510	525	520	527
Main steam pressure	atag	100	85	84	84	83	84
Feed water flow	TPH		125	135	125	150	200
Feed Water inlet temp to ECO	°C	215					
Feed Water Pressure	kg/cm^2	150	136	140	140	139	136
Air and Flue Gas Parameters							
No. of mills in service			1	2	1	1	1
Coal flow	TPH		-	-	-	-	-
Total Air flow	TPH		-	-	-	-	-
BF gas flow (x 10^3)	M^3/hr	96	38	74	70	60	80
BF gas pressure	mmwc						
CO gas flow (x 10^3)	M^3/hr	18	Passing	passing	passing	passing	passing
CO gas pressure	mmwc						
Hot air temperature at mill inlet	°C	350	262	210	270	238	290
Air dust temperature after mill	°C	85	85	80	80	75	80
Mill fan suction vacuum	mmwc		480	495	367	300	621

Description	**Unit**	**Design/Max.**	**U#1**	**U#2**	**U#3**	**U#4**	**U#5**
Mill fan discharge pressure	mmwc	750					
Flue gas temp. after Convective I S/H (L&R)	°C	600					
Flue gas temp. at top economizer inlet (L/R)	°C		590 / 599	560 / 552	565 / 575	593 / 580	580 / 578
Furnace Pressure (Left / Right)	mmwc	-4	+6 / +6	0/0	+1 / +1	-1 / -1	-2 / -2
O_2 %	%	2-4	4.2	5.5	5.4	2.3	3.8
Motor Current							
ID Fan A/B	Amp	75	66 / 68	75 / 75	70 / 70	70 / 70	68 / 66
FD Fan A/B	Amp	22	08 / 18	12 / 10	14 / 12	15 / 16	17 / 18
Ball Mill A/B	Amp	64	44	40 / 44	40	42	42
Mill Fan A/B	Amp	34	32	20 / 25	42	20 / 18	22

3.0 STEAM GENERATOR AND AUXILIARIES SPECIFICATIONS

STEAM GENERATOR AND AUXILIARIES SPECIFICATIONS

3.1 GENERAL

3.1.1 Scope of Work

The scope of work envisaged for the proposed R&M work is categorized into following broad categories:

a) Pre bid site visit by prospective bidders to analyze the site condition and finalize work quantum required for testing / inspection of the equipments.
b) Bidders are required to collect all the necessary information during pre bid site visit.
c) Bidders are required to finalize any necessary scope based on inspection of the unit and discussions for boiler and auxiliaries and boiler main structure during pre bid visit.
d) Engineering / Re-engineering / Re design work of the furnace as specified in the specification.
e) Supply of equipments / Items would be as specifically required by the Owner mentioned in this specification.
f) Services, like dismantling and removal of scrap to specified location should be planned to fit the schedule of the shutdown period. No, extra time would be given for carrying out the same. Erection, commissioning, trial operation, and testing including Performance Guarantee Testing should be planned to fit the schedule of the shutdown period. No, extra time would be given for carrying out the same
g) Associated civil and structural works essential for completion of scope.
h) Repair / overhauling of all components / systems / subsystems necessary to ensure sustained commercial, safe operation at rated output.
i) Along with the replacement/ retrofitting activity to be done under the scope of R&M, bidder has to undertake a complete overhaul of the boiler plant and finally carry out the outer painting with appropriate industrial paints with owner's approval.
j) Provide all the necessary calculations, drawings & other related O&M documents for the equipment supplied.
k) Any other work which is not covered in the above, but in the spirit of essentiality for successful completion of the R&M scheme to achieve targeted output and performance will be in scope of the bidder.

3.1.2 Scope of Engineering/ Re-Engineering / Re-Design work

Major scope involves Re-engineering / re-designs of:

a) Gas tight furnace with furnace vacuum -4 mmWC (at reference level of 21 m) at all operating conditions for rated steam parameter of steam flow of minimum 176 TPH (firing coal of GCV 3800 kCal/kg) & minimum 210 TPH (firing both coal and gas) at 100 ata and 540 °C at superheater outlet.
b) The furnace roof to be made leak proof with membrane type arrangement to ensure gas tight sealing.
c) Pressure parts with membrane type water walls, with necessary modifications in headers and pipings.
d) Integral piping with necessary modifications to suit to the new furnace design.
e) Structural steel work up to 200 MT including beams, ladders, platforms, support and foundation bolts, insert plates etc. Any extra work done would be on unit rate basis.
f) Furnace to be designed for burning coal of GCV 3800 Kcal/kg as primary fuel with BF and CO gas as secondary fuel. Separate/co-axial burners are proposed for meeting the above requirements.
g) All internal piping for steam & feed water impulse & sample, service air, instrument air, etc., within the boundary limit are to be replaced.
h) Burner system by supplying new burners along with their firing control system based on PLC / DDCMIS including associated valves (pneumatic / electromagnetic valves) and instrumentation. Associated panel, cables and local instrumentation is in the scope of the

bidder. The supplied PLC / DDCMIS shall have provision for including all the existing controls as per details given in Annexure – 2 of Technical Specification (C&I Section). Any additional required tapping points along with root valves, as required, is in the scope of bidder.

i) Dampers, expansion bellows and associated controls / piping based on conditional assessment of the same.
j) Attemperator system comprising of direct spray type (single or double stage as per the technology used, conforming the provenness of the system). The above condition should conform to meeting the design super heater inlet and outlet temperatures and pressure parameters at different loading conditions.
k) Flue gas temperature at Air-Preheater top block inlet to be restricted between 384 °C and 395 °C.
l) Valves and fittings
m) Vents up to safe elevation
n) Instrumentation control panels
o) Insulation and refractory
p) Bidders to provide the CFD model of the boiler for dynamic operating conditions.
q) Bidders to carry out overhauling and repair work in the areas of boiler & auxiliaries that is not covered in the R&M scope mentioned above. Bidder to quote the price for the overhauling job along with the R&M job. The detail scope of overhauling is attached in Annexure - III
r) All other auxiliaries and steam generator components required for safe, reliable and continuous year round steam generation.
s) Modification of Bottom Ash Handling system to accommodate the new design of Boiler.

Owner intends to retain unit out put on sustainable basis. Contractor shall include in his scope of work any minor modification (if required) in the boiler pressure parts, to meet the proposed unit output considering the use of coal quality specified (design CV 3800 Kcal/kg) to achieve balance of flue gas and steam temperatures.

The bidder is required to retain the existing second pass of the boiler and to match the first pass of the boiler with the second pass with the available technology ensuring gas tightness and thermal expansion at dynamic load condition.

Engineering / design of all other system including civil system / equipment as required / specified to fulfill the intent of this specification and meet the overall objectives.

3.1.3 General requirement

Specified hereafter in this section are the Owner's minimum requirements which are to be complied with / satisfied for various Equipments / Systems which are to be supplied new / replaced by the Contractor in course of renovation work as per the scope of works detailed in this specification for Steam Generator and auxiliaries.

Furnace exit plane is defined as the plane, vertical plane above furnace nose tip for two pass steam generator. For maintaining Furnace exit gas temperature (at furnace exit plane) less than Initial Ash Deformation Temperature (IDT) minus 60 °C mentioned in table titled "Ash Fusion Range" under Clause no. 3.1.4 and to balance the temperatures of flue gas and steam, minimum retrofitting / redesigning of superheater panels are required. The Bidder shall have to carry out the detailed analysis of the existing design of the steam generator for assessment of the requirement specified elaborately in this specification with the range of coals and other inputs made by the Owner. If needed, Bidder shall also work out the complete thermal redesign of the steam generator for making suitable adjustments in the heat transfer surfaces as mentioned

above to satisfy all requirements with the specified design criteria. Bidder has to furnish the design parameters in data sheet.

However, the Bidder's utilization of various specified requirements indicated by the Owner shall in no way relieve the Bidder of his responsibilities to meet the targeted objective of renovation, or of providing sustained, safe, commercial operation of the plant.

The Owner's specified requirements are indicated below (in Table 3.1).

Table-3.1: Specified requirements

a)	Steam generation operating condition: (i) Capacity: Minimum 176 TPH with coal only and minimum 210 TPH with coal & gas. (ii) Furnace draft: -4 mmWC (iii) Flue gas temperature at inlet to APH top block shall be between 384 °C and 395 °C.	a) With design coal at BMCR conditions b) With BF Gas pressure of 100 mmWC to 600 mmWC and CO Gas pressure of 50 mmWC to 400 mmWC at terminal points

3.1.4 Design Coal

Gross Calorific Value of 3800 Kcal/Kg.

Proximate Analysis

Test Type	Moisture %	Ash %	Volatile Matter %	Fixed Carbon %
As fired basis	10.00	45.00	10 – 25	30 - 45

Ultimate Analysis

Test type	Moisture %	Ash %	C%	H%	N%	S%	O%
Air dry basis	3	36.05	45.98	2.81	0.91	0.44	3.81

Coal Hard Groove Index – 55

Ash Initial Deformation Temperature – 1100°C

Ash Fusion Temperature – 1300°C

3.1.5 Worst Coal

The worst coal predicted is same as that of designed coal of GCV 3800 Kcal/Kg.

Note:

Design Coal: The Steam generator shall be capable of delivering the steam at MCR output conditions and guaranteed performance using the design coal.

Performance ash / furnace oil analysis as available from site.

Ash Analysis:

SiO_2	59.29%
Al_2O_3	27.28%
Fe_2O_3	6.59%

TiO_2	1.52%
P_2O_5	0.55%
SO_3	0.43%
CaO	1.05%
MgO	0.38%
Na_2O	0.41%
K_2O	2.49%

Furnace Oil Analysis:

Grade	1500 secs conforming to IS: 1593.
Flash Point	65 minimum (Degree C).
Viscosity (RWI)	80 – 90
Water Content (Max.)	1 % by volume
Sediments (Max.)	0.25 % by weight
Ash (Max.)	0.1 % by weight
Sulphur (Max.)	4.5 % by weight
Acidity	Nil
Specific Gravity at 15 degree C	0.95
Gross CV	10000 Kcal/Kg

BF Gas Characteristics:

CO	23%
CO_2	17%
CH_4	0.75%
H_2	3.5%
N_2	56%

3.2 PRESSURE PARTS

3.2.1 Design of Pressure Parts

The design of pressure parts which are to be replaced (tubes, headers, etc.) shall be supplied by the Contractor as per Indian Boiler Regulations (IBR) or other acceptable international codes whichever is superior. It is however, the responsibility of the contractor to get on behalf of the Owner various calculations and other technical documentations approved by the statutory authorities in the country.

The thickness of the pressure parts (steam and water tubes/headers, etc.) shall be calculated using IBR formulae / factor of safety etc. (and not as per codes / formulae not acceptable to IBR). Such thickness as per IBR formulae shall be arrived at after allowing for tube bend thinning allowance, where applicable as per IBR / accepted International codes conforming to the IBR. The supplied pressure parts shall conform to the IBR in respect of tolerances, freedom from defects and mechanical tests. The pressure parts shall accompany with the IBR III-B certificate and approved drawings along with dispatch.

3.2.2 Material of Pressure Parts

The material used for Boiler pressure parts including boiler tubing, headers, piping, vessels, valves & fittings etc. and other components shall be equal to or better than the following unless specified otherwise:

Design Metal Temperature	**Material**
Up to & including 400°C	Carbon steel to ASTM A-106 Gr. B/C or SA 210C or approved equivalent.
Above 400°C but below 550°C	Alloy steel to ASME SA-335: P-11/P-12/P-22 / -23; ASME SA213:T-11/T-22/T-23 or approved equivalent
Up to & including 605°C	Alloy steel ASME SA- 335 / 213 P-91 / T-91, T-92 or approved equivalent
Above 605°C	Austenitic Stainless steel, 304 H, TP 347 H or approved equivalent

3.2.3 Scope of Work (General)

a) Replacement of the water wall tubes from bare wall tube design to membrane wall is to be done.
b) Water wall headers have to be re-designed to accommodate the membrane type design.
c) Replacement of roof SH with membrane tubes covering 1st & 2nd pass roof.
d) The joint preparation and repairing Weld Preparation System (WPS) shall be checked and approved by inspecting authority before start of erection work.
e) Minor modifications of the pressure parts to be done in the available space to ensure that the gas and steam parameters are within the design margin and that the flue gas temperature at Air-Preheater top block inlet is restricted between 384 °C and 395 °C.
f) Stress relieving of welded joints where ever requires shall be carried out.

3.2.4 Economizer

The scope of work has been covered in Annexure – III: Overhauling Scope of the Technical Specification (Item no. 17 & 18). Overhauling scope of work and material for execution shall be provided by the owner. However, if any minor modification is envisaged by the bidder to accommodate their proposed design, the same shall be in bidder's scope.

3.2.5 Water wall & Roof tubes

3.2.5.1 Existing Water Wall & Header details

S. No.	Particular	Unit	Values/range
A)	**Front Water wall tubes**		
	Material	--	SA210GrC
	Number	--	152
	Size (OD x thickness)	mm	60.3 x 5
	Front Water wall headers		
	Material	--	SA210GrC
	Size (OD x thickness)	mm	273 x 26
	Length of lower left & lower right header	mm	2432
	Length of lower inter left & lower inter right header	mm	2656
B)	**Rear Water wall tubes**		
	Material	--	SA210GrC
	Number	--	152
	Size (OD x thickness)	mm	60.3 x 5
	Rear Water wall headers		

S. No.	Particular	Unit	Values/range
	Material	--	SA210GrC
	Size (OD x thickness)	mm	273 x 26
	Length of lower left & lower right header	mm	2432
	Length of lower inter left & lower inter right header	mm	2656
C)	**Left Water wall tubes**		
	Material	--	SA210GrC
	Number	--	105
	Size (OD x thickness)	mm	60.3 x 5
	Left Water wall headers		
	Material	--	SA210GrC
	Size (OD x thickness)	mm	273 x 26
	Length of lower left & lower right header	mm	2432
	Length of left middle header	mm	2304
D)	**Right Water wall tubes**		
	Material	--	SA210GrC
	Number	--	105
	Size (OD x thickness)	mm	60.3 x 5
	Right Water wall headers		
	Material	--	SA210GrC
	Size (OD x thickness)	mm	273 x 26
	Length of lower left & lower right header	mm	2432
	Length of middle right header	mm	2304
E)	Total water wall heating surface	m^2	3829
	For all A,B,C & D above		
1.	Intended Working pressure at header (design)	Kg/cm^2	115
2.	Intended working header metal temperature (design)	°C	320/330

3.2.5.2 Scope of Work & Supply

a) Water wall tubes are to be replaced from the existing bare tube staggered arrangement to membrane type with new separate burner panel to accommodate both coal and gas burners. The design shall be such as to prevent distortion of steel work due to thermal expansion.
b) The furnace EPRS should be so selected to give acceptable furnace outlet temperatures while firing coal or gas or the combination of both the fuels. The furnace design shall incorporate necessary manholes, peep holes, openings for the fuel distributors, ignition / reflection arch and refractory covering in the lower furnace area if required.
c) The burner panel tube material & size shall be same as that of modified water wall tubes in furnace zone to accommodate the new bigger size burners. The height of the firing zone should be sufficient to completely burn out the coal particles thus restricting the unburnt in bottom and fly ash within design limit. All gooseneck bend tubes of water wall to be replaced.
d) All Bottoms “S” panel including cathouse tubes to be replaced.
e) Provision has to be made to accommodate existing wall and retractable soot blowers.
f) Provision for manhole / peepholes to be made at suitable accessible areas.

g) Proper clamping should be there with provision of required expansion of water wall and roof tubes.
h) Complete assemblies of Water Wall Panels including Headers to be replaced with new assemblies as per new furnace design. Each of the headers shall have at least two numbers of stubs for inspection and cleaning.
i) Complete Replacement of roof tubes with membrane tube along with header.

3.2.5.3 Technical Requirement

a) An additional tube thickness of with suitable tolerance as per IBR norms for water wall tubes shall be provided on all water wall tubes coming within a radius of half a meter of each wall blower to guard against premature tube failure due to soot blowing. Alternatively, fabricated tubes may be provided in the soot blowing radius to guard against impact of soot blowing.
b) There shall not be any flame impingement on water walls.
c) Minimum 10% thinning allowance shall be provided wherever there is a bend in the tubes of furnace and water walls.
d) Bidder to check the feasibility of welding minimum 10 mm diameter carbon steel wear bar on all the corners of the furnace bottom hopper (S shaped panel) up to three meters from the side and additional 0.5m vertical height for prevention of tube damage due to falling slag/ ash erosion. Better solution in respect of the same from the bidder would be acceptable.
e) Adequate numbers of furnace observation and tapping points shall be provided for local instruments, gauges, switches, test pockets etc.
f) The bottom 'S' panel & Goose neck bends shall be of same material as that of modified tubes with thickness as per IBR and other specification requirements.
g) Provide minimum +10% thinning allowance over and above the calculated thickness wherever there is bend in the tubes of 'S' panel.
h) As per NFPA 85 furnace shall be designed so that the maximum head capability of induced draft fan system with ambient air does not exceed the design pressure of furnace ducts and associated equipments. The furnace enclosure shall have sufficient strength to sustain any inadvertent pressure extremity inside it.

3.2.6 Superheaters

3.2.6.1 Details of existing superheater tubes & piping

The scope of work has been covered in Annexure – III: Overhauling Scope of the Technical Specification (Item no. 17 & 18). Overhauling scope of work and material for execution shall be provided by the owner. However, if any minor modification is envisaged by the bidder to accommodate their proposed design, the same shall be in bidder's scope.

3.2.6.1.1 Scope of Work & Supply

The scope of work has been covered in Annexure – III: Overhauling Scope of the Technical Specification (Item no. 17 & 18). Overhauling scope of work and material for execution shall be provided by the owner. However, if any minor modification is envisaged by the bidder to accommodate their proposed design, the same shall be in bidder's scope.

3.2.6.2 Convection Super Heater I

The scope of work has been covered in Annexure – III: Overhauling Scope of the Technical Specification (Item no. 17 & 18). Overhauling scope of work and material for execution shall be provided by the owner. However, if any minor modification is envisaged by the bidder to accommodate their proposed design, the same shall be in bidder's scope.

3.2.6.3 Details of existing Convective Superheater loop I packet

The scope of work has been covered in Annexure – III: Overhauling Scope of the Technical Specification (Item no. 17 & 18). Overhauling scope of work and material for execution shall be

provided by the owner. However, if any minor modification is envisaged by the bidder to accommodate their proposed design, the same shall be in bidder's scope.

3.2.6.4 Convection Super Heater II

The scope of work has been covered in Annexure – III: Overhauling Scope of the Technical Specification (Item no. 17 & 18). Overhauling scope of work and material for execution shall be provided by the owner. However, if any minor modification is envisaged by the bidder to accommodate their proposed design, the same shall be in bidder's scope.

3.2.6.5 Attemperators and Spray system

3.2.6.5.1 Scope of Work & Supply

a) The de-superheating system shall be complete with all required, control valves & bypass regulating valves with suitable valve mounted electrical actuator,piping and supports etc.
b) Superheater attemperation spray system (spray nozzles, liners & assemblies with higher capacity units) with capacities of each Super heater attemperator spray water systems to be re-designed for 15 % of the rated main steam flow.
c) Single/Two stage attemperation system may be considered for better temperature control.
d) Replace existing valves for Super Heater spray system with modified special purpose (multi stage, multi path valve with class V leakage) valves/or zero leak metal contact sealing valves and auto spray controls and measurements to be provided. Necessary isolation valves also to be replaced and included in the scope of work.

3.2.7 Headers

Scope of Work & Supply

The bidder is required to supply new bottom and top header for membrane water wall. Necessary retrofit of the existing superheater and economizer headers to be done to meet the scope requirements.

Technical Requirement

a) All headers shall be located outside the gas path. In case headers are located in the gas path, the same shall be protected by insulation to avoid direct exposure to gas. Downcomers shall be in the totally unheated portions of the steam generator.
b) All headers should be properly supported and provision of expansion should be there.
c) Inspection stubs of length 600mm and 88mm dia size shall be provided in all the headers for suitable access for maintenance and inspection. No hand hole plate assembly design shall be used.
d) The header vents, drains, pressure gauges, steam and safety valve connections shall be of weld-end type. Instrument tapings as required including test connections shall be provided.
e) The superheater outlet headers shall be of the extended type to accommodate the safety valves.
f) All tubes or attachments to headers shall be full strength welded. No seal welded joints shall be used.
g) All headers shall be thoroughly cleaned and be free of scale by shot blasting on the inside.
h) Drains from steam drum, headers, gauge glasses and integral piping of steam generator shall be terminated into one or more drain collection headers which will be connected to blowdown tank.
i) For Nitrogen (N_2) blanket and N_2 preservation in case of header replacement, suitable connections for N_2 supply shall be provided as per manufacturer's recommended procedures. Nitrogen will be provided at one point at 16 kg/cm^2 (g) approximately. Further piping up to equipment for the preservation of the boiler, draining of the boiler and purging of the gas line including pressure control station if required any and required instruments shall be in bidders' scope. The purging for the burner gas lines up to the nozzle/spud/burner inlet shall be automatic.

3.2.8 Buckstays

Scope of Work & Supply

a) Replacement of buck stay and railings floor grills etc as per new furnace design.
b) All buck stay including the corner fixing arrangement, sealing of gaps and refractory work is proposed to eliminate air ingress in this area.

3.2.9 Valves

3.2.9.1 Scope of Work & Supply

Bidder to retrofit / replace the existing impulse type drum safety valves within the existing arrangement.
Bidder to replace the existing superheater impulse type safety valves with new spring loaded safety valves. Bidder to also provide silencers for the existing start-up vent valves.

3.2.9.2 Technical requirement

a) Specific requirement of valves:
   i. For valves, the direction of flow shall be clearly stamped on the body of the valve.
   ii. Hand wheels for all the valves shall close the valve in clockwise direction when viewing from the top. All hand wheels shall be clearly marked indicating the direction of opening/closing.
   iii. For safety relief valves and start-up vents the allowable noise level shall not exceed 115 dBA for one quarter hour or less per day.
   iv. All valves shall be provided with proper name plates indicating complete information about the valves.

3.2.10 Hangers & Supports

3.2.10.1 Scope of Work & Supply

All the boiler hangars and supports shall be replaced with new ones within the scope boundary based on the existing stress and new values in case an additional load change in considered in the design.

3.2.10.2 Technical Requirements

a) Design & manufacturing of piping hangers and supports should conform to ANSI/ASME code for pressure piping, B31.1.
b) Each threaded connection and adjustable rod shall be with lock nuts.
c) Hanger support rods of less than 10 mm diameter for supporting pipes of 50 Nb and smaller and less than 13 mm diameter for supporting pipes of 65 mm Nb and larger, shall not be used.
d) Attachments to piping shall be by clamps/lugs. Bolted pipe clamps shall have a minimum thickness of 5 mm for weather protected locations and 6 mm for locations exposed to weather. Beam clamps shall be forged steel equipped with a rod to fix a nut.
e) All sliding surfaces of supports and restraints shall have Teflon lining on one surface coming in contact with stainless steel lining on the other surface.
f) All pipes hangers and supports shall be designed to withstand all static and dynamic loading conditions which act upon the system and associated equipments. Piping supports and equipment loading condition to be considered may include but are not limited to:
   i. The total load of pipe, fittings, valves, insulation and medium transported or test medium whichever is heavier. The total calculated load should minimize the effect of piping system loading on the structure.
   ii. Thermal expansion and contraction.
   iii. Stress from cyclic loading of equipments.
   iv. Vibration transmitted to or from equipment or terminal connection.

v. Wind loading on outdoor piping.
vi. Loading due to seismic forces if required by code or specification.

g) All rigid rod hangers and variable spring shall be designed to carry the operation load in hot condition. Where hangers' rod angularity exceeds 4 degrees from cold to hot position, the hanger and structural attachments shall be offset in the cold position in such a manner that the hanger rod is vertical in hot position unless otherwise specified.
h) The values of cold and hot settings of the hangers along with end moments and forces shall be supplied.
i) Bidders need to submit the detail stress analysis report based on above load calculation.

3.2.11 Penthouse

3.2.11.1 Scope of Work & Supply

a) Ceiling tubes hanger's replacement. Modified spring type sealing arrangement with better refractory system having plastic refractory material to avoid ash ingress in to the pent house.
b) Replace pent house casing with new insulation
c) Repair of Boiler roof with new powder coated sheets or Corrugated Metapoly Sheets.

3.2.11.2 Technical Requirements

a) Restoration of Hangers inside pent house.
The hangers inside the penthouse are to be repaired / replaced and restored as per requirement of the new furnace design.

b) Modified spring type sealing arrangement with better refractory system having plastic refractory material:-
The gaps between vertical coils entering pent house & horizontal ceiling tubes are required to be repaired/ sealed with castable refractory and asbestos roof.

c) Replacement of penthouse refractory and casing:-
Castable refractory is required to be laid over the tubes & then a 3 mm casing of boiler steel is to be provided over it to avoid flue gas /ash leakage.

d) Repair of Boiler roof with new powder coated sheets.-
The Boiler roof is also to be repaired with new powder coated sheets or Corrugated Metapoly sheets. The most common polymers used are polyester, polyester-epoxy (known as hybrid), straight epoxy (Fusion bonded epoxy) and acrylics.

3.2.12 Piping

3.2.12.1 Steam generator Integral Piping

3.2.12.2 Scope of Work & Supply

The Bidder can reroute / replace the integral piping like uprisers, downcomers, etc., to accommodate their proposed design or keep the existing system to complete the circulation circuit. In case of keeping the existing system, the Bidder has to replace complete upriser pipes and all downcomer bends (approximately 500 nos. of dimension 133 mm × 7 mm).

3.2.12.3 Technical Requirements

a) The integral pipe work shall consist of blow off bends, high and low pressure drains, water gauge piping, water and steam connections to feed water regulator, feed pipe work from economizer outlet manifold to the steam generator steam pipe works, safety valve escape pipe works, upriser, downcomer etc.
b) The steam generator integral piping consists of all the interconnecting piping between one meter away from the economizer inlet header and the superheater outlet header up to MSSV.

c) The number of size and the arrangement of these integral piping shall be based on the permissible pressure drops in these pipes and the distribution required in the respective headers of the various sections of the steam generator.
d) These piping shall be properly supported and provided with the required tapping, stubs and thermo wells for measurements.
e) The calculation of wall thickness required for pipelines subject to internal and / or external pressure shall be as per IBR. Adequate allowances shall be made towards thinning due to bending, weakening at branch connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc. and the same shall be subject to approval by Owner/Consultant. In any case a minimum corrosion allowance of 1.0 mm shall be considered while selecting the thickness.
f) Formal flexibility analysis calculations shall be carried out in case of pipelines subjected to restrained thermal expansions or contractions and the report to be submitted to the owner / consultant for approval.
g) All pipelines with size greater than NB 50 mm are considered as shop fabricated piping and detailed piping layout drawings shall be prepared for all such pipelines.
h) Detailed bills of material shall be prepared for all piping systems. In case of shop fabricated piping, the bill of material shall correspond to the layout drawing prepared.
i) All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment, etc. Adequate clearances shall be ensured with respect to the above to accommodate insulation and pipe movements.
j) The piping shall be arranged to provide clearance for the removal of equipment requiring maintenance and for easy access to valves and other piping accessories required for operation and maintenance.
k) Overhead piping shall have a minimum vertical clearance of 2.3 meters above walkways and working areas and 8.0 meters above roadways.
l) Drains shall be provided, at all low points and vents at all high points as per actual layout. Pipelines shall be sloped towards the drain points.
m) All pipe racks shall be provided with walkways of 750 mm wide.
n) All pipe bends shall have a radius of five nominal pipe diameter unless otherwise specified by the Owner / Engineer.

3.2.13 Coal, Oil and Gas Burners

3.2.13.1 Scope of Work & Supply

a) Replacement of existing multifuel (coal, oil & gas) separate / coaxial burners with modified wall mounted coaxial / separate coal & gas (BF & CO) swirl burners with special long lasting burner tips and maximum NO_X 300 mg/NM^3.
b) Provision for new multi fuel scanner and igniters (High Energy Arc Igniter). Direct firing is possible with furnace oil. (Complete replacement of burner panel for accommodating the new burner, new igniters, new scanners).
c) Replacement of oil gun as per O&M and the requirement of new modified ignition systems
d) Provision for new secondary and fuel dampers with separate operational system to have flame optimization and combustion control to meet the variation in coal quality
e) Provision for nitrogen purging at suitable location is to be considered.

3.2.13.2 Technical Requirements

A. Coal Burners

a) Existing coal burners shall be replaced with new coal burners suiting the coal demand of the modified furnace design. The new coal burner shall be designed to take care of following requirements:
   i. The minimum turndown ratio of coal firing system shall be 2:1.

ii. The coal burner design shall ensure a steady log mean density of coal air mixture distribution as it enters the combustion zone, without allowing the coal dust to settle down.
iii. The burner design shall minimize erosion and the flame should not touch the water walls.
iv. The burners shall be designed to ensure smooth variation in the fuel flow without affecting the air fuel ratio.
v. The air fuel ratio around the burner shall be optimized to ensure low emission of NOx.
vi. The NO_x emission under various conditions & regime of operation shall at no time exceeds the permissible.

b) Each coal burner shall be served by individual separate coal pipe. The material and construction of burner including burner tips should withstand radiation from the furnace when not in use, and shall not be damaged. Parts subjected to high temperature which cannot be protected by other means shall be made of alloy steel. The burner design shall be such as to be free from distortion & deposits under all operating condition in the furnace. The angle of confluence between the coal burner primary air and secondary air shall be such that the inherent carbon monoxide produced is removed by scrubbing action without any significant reduction in velocities of the air stream.
c) Burners parts subject to abrasion shall be coated with suitable coating / lining for erosion resistant (preferably ceramic). The minimum operating life of burner parts without any major maintenance and replacement shall be 16000 hrs.
d) Burner shall be removable or replaceable from outside the steam generator without entry to the furnace.

B. Gas Burners

The bidder is required to supply gas burners capable to fire both BF and CO gas. The new gas burner shall be designed to take care of following requirements:

a) The burner shall be designed to cater to 50% BMCR condition and shall also be capable for being fired along with coal burners. Each BF and CO gas burner shall be capable for burning minimum quantity of each gas as per existing capacity (Clause 2.5, Page no. 15 of 113).
b) The burner should be designed for handling large gas volume and create adequate turbulence for effective air/fuel mixing.
c) Suitability of all burner components for above-mentioned area and ambient conditions.
d) Availability of Burner shall be min. 98 %
e) The firing scheme shall incorporate automatic purge interlock to facilitate restarting after such conditions. Automatic ignition system to initiate the flame in the furnace shall be included. However facility for the manual operations shall also be provided. Ignition system shall be complete with igniters suitable for ignition of fuel directly. Necessary piping, valves, control and instrumentation and all other equipment necessary for the completeness of this system shall be provided.
f) The system shall be designed for burning gas even when the furnace is under cold condition (i.e., capable of cold start up with gas).
g) Gas and air piping should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.
h) Each branch of gas burners shall have one isolating valve as per NFPA requirement for the isolation of a branch from rest of the branches. One manual isolation valve shall be provided on both CO and BF Gas lines to isolate all burners. Bidder to confirm boiler can be operated with one branch isolation. These Valves shall be arranged based on the feasibility in the layout.

i) Minimum velocity of gas should be 12 m/s for BFG/CO gas shall be maintained to avoid settling of tar and dust at lower velocity which can create problems of chocking in nozzles.
j) The turndown ratio should be about 6:1. BFG pressure shall vary from 100 to 600 mmWC and COG pressure shall vary from 50 to 400 mmWC at the terminal points.
k) The air fuel ratios around burners shall ensure low NO_X emission at all load condition.
l) The burner design should be such that the excess air requirement should be within the range of 7% to 10% depending upon the furnace configuration, combustion air temperature and operating load.
m) The safety shutoff valve ahead of the flow control station and individual burner/Nozzle/Spud shutoff and vent valves shall be furnished with motorized drives. Block and Bleed valves shall be provided on BFG & CO Gas as per the NFPA requirements.
n) All flanges shall be in accordance to ASME B16.5.
o) Block & bleed valves, purge valves shall be mounted in series and installed near each burner/ nozzle/spuds.
p) The burner should have Fixed/ Adjustable Gas spuds with stabilizers, connected to a common ring header
q) A vent valve shall be connected to the intermediate pipe piece between two block valves. The discharge pipe from the vent valve shall be led to a safe location above steam generator roof. The vent valve shall open to atmosphere simultaneously with the tripping of the burner shutoff valves and vent valves shall be supervised by the BMS logic.
r) The burners should have in built observation ports to provide visual access to the flame. The observation ports should be protected by temperature resistance glass.
s) The burners shall be provided with their separate flame sensing devices so that the admission of fuel may be automatically shut off and gun withdrawn in case of flame failure. The flame sensing devices shall be self-contained and shall be unaffected by dirt, oil film and ambient conditions.
t) The burners should have in built igniters. The electrode material should be of non consumable type and capable to withstand radiation from the flame without retraction while the burner is firing.
u) Automatic and manual Shut off valves for gas atomizing and clearing media
v) The burner should have fuel flow control valves and flow meters.
w) The burner should have flexible hose piping for easy connectivity.
x) The burner should have proven combustion control system with control of fuel air and secondary air control to maintain proper fuel ratio in combustion zone.
y) All valves, joints in the pipelines etc. shall be completely 100% leak proof.
z) Nitrogen purging system shall be provided for the burners to clean and purge the burners. The Nitrogen purging shall be after the block and bleed valve of individual burner/nozzle/spud as per the manufacturers practice. Hard deposits of tar shall be removed during the annual / regular maintenance of the boiler. However provision shall be made in burner for easy removal of spuds during maintenance.
aa) The design criteria for the equipments in and around the BFG, Coke oven Gas shall follow the Hazardous area classification as mentioned below.
    i. For BFG area Class – I, Zone – II, Group – II A, T2 to the extent of IS – 5572.
    ii. For Coke Oven Gas it is Class – I (Group C), Division 2, Zone – II, Group – II B T2 to the extent of IS – 5572.
bb) The burners shall be remotely operated and the entire operation of initial purging and fuel gas/fuel oil firing shall be automatic after the initial command. Adequate number of position indicating contacts for integration into BMS logic shall be provided.

3.2.14 Ducts, Dampers & Actuators

3.2.14.1 Scope of Work & Supply

Secondary air ducting including dampers and expansion joints within the specified terminal points is within the bidder's scope of work. The list of actuators required for the duct outside the

specified terminal points along with the type is furnished in the amended Annexure – II of C&I which has to be procured by the bidder and installed in the ducts outside the specified terminal point.

Except to the extent specified above, all other air and flue gas ducting and expansion bellows scope of work has been covered in Annexure – III: Overhauling scope of the technical specification (item no. 4 & 8)

3.2.14.2 Technical Requirements
Replacement of Dampers & Actuators

Need based repair/ replacement of the existing Dampers & Actuators to be carried out as per the technical requirements stipulated in the following clauses:

a) Bidder shall furnish a list of all dampers, their purpose and torque rating etc. together with the details of actuators and accessories for control from PLC / DDCMIS system. Powered dampers shall also have provisions for manual operation during emergency/ maintenance along with graduated local position indicator.
b) The dampers shall be of heavy-duty construction. All dampers/louvers shafts shall be rigidly constructed to prevent bending, vibrations and distortion. They shall be balanced about the bearing shaft axis.
c) The frames of the dampers shall be rigid and self supported. The control dampers and isolation dampers shall be electrically operated.
d) All dampers shall be designed to withstand the operating air and flue gas temperature without distortion. The spindles shall be adequately sized and bearings suitably insulated to protect over-heating. The construction shall be such that the shaft bearings are mounted outside the damper box channel and arranged for convenient inspection.
e) Stuffing boxes shall be provided on all damper blade shafts.
f) The isolating damper design shall provide positive shutoff when closed.
g) All regulating dampers controls coming under auto regulation shall be able to provide the desired relationship between percentage opening and the flow.
h) The auto regulating dampers shall be capable of being operated between 20% to 80% opening as per the optimal requirements of control systems to achieve stable, steady and smooth automatic control of the plant and processes under all operating conditions.
i) All dampers shall be arranged to facilitate local manual operation from a gallery or floor level. The operating gear shall be fitted with a graduated indicator and shall be designed such that the damper may be retained in any position. The isolating dampers shall, in addition be fitted with locking devices to permit locking in the fully open and shut positions.
j) Backlash, play, etc. with linkage mechanism, actuator and final control element shall not affect the proper function of all shut off &regulating dampers.
k) Thermal expansion of ducting shall not produce stress in louvers, linkage arrangement etc.
l) Outlet dampers of scanner air fans and emergency dampers of scanner air shall be dead weight gravity type.
m) All the inlet dampers shall be located in horizontal duct.

3.2.14.3 Replacement of Metallic (SS) Expansion Joints

Replacement of metallic expansion joints with new metallic expansion joints within the new terminal points of R&M. Out of this scope, compensator will be provided by the owner.

Need based repair/ replacement of the existing expansions joint shall be carried out conforming to the following stipulations:

a) The expansion joints shall be of metallic multi-bellows construction and shall be used to reduce the reactions (forces and moments) at the connected equipment terminals due to thermal expansion/connection and/or vibration of connected equipment and piping.

b) The design, material, construction, manufacture, inspection, testing and performance of the expansion joints shall comply with the currently applicable requirement of EJMA, Boiler and Pressure Vessel Code Section III, ANSI B-31.1 and all statutes, regulations and safety codes.
c) Expansion joints suitable for the service conditions and most adverse operating conditions of the ductwork shall be provided.
d) Expansion joints shall not support the ductwork.
e) For the flue gas ducts or for air ducts where ingress of ash / dust particles from atmosphere or air preheaters etc. is expected, the expansion joints shall be designed with suitable insulation pillow / bolsters to take care and avoid dust accumulation.
f) The minimum trouble free operational life of expansion joint shall not be less than 20000 hrs of operation from the date of commissioning.

3.2.14.4 Technical requirement for Ducts

a) The ducting system shall be complete with all required expansion joints, mating flanges, dampers (interconnecting, isolating and control dampers), supports, access doors, platforms insulation's etc. The top of the ducts and /or the outer cladding shall be cambered to facilitate drainage of water.
b) The duct work shall be free to expand, but it shall be rigid against wind and seismic disturbances. Adequate provision shall be made for all expected expansion or contraction.
c) Main Air & Flue Gas ducts shall be rectangular in cross section and will be of welded construction, properly stiffened and reinforced. However, small air ducts, such as Scanner Air duct, Core Air duct, etc., may be of circular cross section.
d) Access and inspection doors shall be provided at suitable locations. The access doors shall be of a minimum size of 450 mm x 450 mm.
e) Necessary regulating and isolating dampers at suitable points are to be provided for the efficient operation and maintenance of the steam generator. All the dampers shall have an effective area not less than that specified for the ducts they control.
f) Isolation dampers should be of guillotine type flow control damper shall be of 'louver' or butterfly type with the necessary frames, shafts, blades, bearings, linkages, seals, etc.
g) All air and flue gas ducting shall be leak proof to avoid pressure losses and atmospheric air entry etc.
h) All supporting steel work hangers, thrust brackets and castings for the ducts shall be provided.
i) Performance guarantee (PG) test points at APH inlet and outlet and FD fan outlet duct to be provided at suitable location.
j) Acoustic insulation if required shall be used on air and gas ducts to restrict the noise level to less than 85 dBA at 1.0 m from duct outline.

Type of duct construction:

Main Air & Flue Gas ducts shall be rectangular in cross section and will be of welded construction, properly stiffened and reinforced. However, small air ducts, such as Scanner Air duct, Core Air duct, etc., may be of circular cross section. Following requirements shall be complied with:

a) 6 mm thick steel plates for gas ducts.
b) 5 mm thick steel plates for air ducts.
c) A corrosion allowance of 1.5 mm shall be considered for stress calculation for the flue gas ducting.
d) Duct stiffening shall be by means of rolled sections.
e) The thickness of the duct plate shall be suitably increased, if required, in the transition zone at Steam Generator outlet where the flue gases change direction, to increase the wear life of the duct plates.

Material of Construction:

a)	Duct plates, turning vanes perforated plates.	:	ASTM A 36 or equivalent (For ducts operating above 400°C gas temperature, suitable Alloy steel material shall be provided to Purchaser's approval).
b)	Structural shapes	:	ASTM A 36 or equivalent
c)	Pipe struts, trusses, bracing	:	ASTM A 53 or equivalent seamless steel pipe.
d)	Erection bolts for ducts	:	ASTM A 307 or equivalent
e)	Bolts for connection to structural steel	:	ASTM A 325, AISIA 325 (friction type) or equivalent
f)	Stainless Steel	:	ASTM A 316 L
g)	Gaskets	:	"Relrosil" by Hitco or equivalent
h)	Access & Inspection doors	:	Reinforced Steel Plates.

3.2.15 Boiler Structural Columns, Floor grills, platforms, railings etc.

3.2.15.1 Scope of Work & Supply

Bidder to quote for only 200MT of structural steel as the same is only available for the repair/ replacement of boiler structural columns, floor grills, steps & hand rails, and other exposed metallic parts vulnerable to corrosion in the scope of this specification. However, unit rate shall be given for requirement of the additional quantity.

3.2.15.2 Technical requirements for boiler structural columns

a) Columns shall be designed to support the load combination, which produces the maximum interaction ratio. Exterior columns shall be designed to resist wind moments between braced elevation as appropriate. Columns shall also be designed to resist moments caused by discontinuous vertical bracing or non-concentric bracing work points.

b) Main structural elements will be welded continuously. Intermittent welds will be used only on secondary members, which are not exposed to weather or other corrosive influence. The size of fillet welds will not be less than 6mm.

c) Connection and splices will be made by welding or bolting with high tensile turned and fitted bolts. For bolted joints, min. two bolts will be used.

d) Fabrication of all structural steel work shall be done in accordance with IS: 800 "Code of practice for use of Structural Steel in General Building Construction". Workmanship shall match to the best practice in modern structural shops.

e) All steel and other materials used for steelwork and in association with steelwork will conform to appropriate Indian standards.

f) The Bidder will be responsible for the design and the detailing of all connections. The design of connections will provide for adequate strength for the transfer of force in the structural elements indicated on the design drawings. For purposes of detailing of connections, the allowable stresses in material, bolts and welds will be as per IS: 800 and IS: 816 or as specified in the design drawings.

g) For all full strength butt welding of plates and sections thicker than or equal to 10mm, edge preparation will be done and got approved by the Owner / Consultant.

h) Two numbers of washers will be used for all bolted connections, one washer bearing against the head and other bearing against the nut.

i) The welding and welded work will conform to IS: 816 and other relevant codes unless otherwise specified. Electrodes will conform to IS: 814 and will be approved by the Owner / consultant.

j) Welding will be done by Electrical Arc Process. Automatic welding will be employed for important structures as specified in the drawings. Generally, submerged arc, Automatic & Semi-automatic welding will be employed. Only where it is not practicable, Manual Arc welding may be resorted to. In case of Manual Arc Welding, recommendations of electrode manufacturer are to be strictly followed.

k) Only qualified welders suitable for the job will be employed. The Owner/ consultant at his discretion can order periodic tests in accordance with IS:817 of the welders and/ or of the welds produced by them at no extra cost. Welds will be made using requisite jigs and fixtures to avoid distortions or damage to members during/ after welding. Welds on exposed work will be finished uniformly smooth to present a neat appearance.

l) All electrodes for use in the work to which the specification relates will be kept under dry conditions. Electrodes which are damaged by moisture will not be used unless it is certified by the manufacturer that when it is properly dried there will be no detrimental effect. Any electrode which has part of its flux coating broken away or is otherwise damaged will be discarded.

m) The Bidder will prepare the edges with an automatically controlled flame cutting torch followed by grinding correctly to the shape, size and dimensions of the groove, prescribed in the design and shop drawings in case of U-groove joint, the edges will be prepared with an automatic flame cutting torch in two passes following a bevel cut with a gouging pass, or by machining.

n) The welding surfaces will be smooth, uniform and free from fins, tears, notches or any other defect, which may adversely affect welding. Welding surfaces or the surrounding surfaces within 50mm of weld will be free from loose scale, slag, rust, grease, paint, moisture or any other foreign material. Pre-bending of plates for three plate welded sections will be done where found necessary.

o) After completing each run of weld, all slag will be thoroughly removed, and the surface cleaned before starting the next run of weld. The weld metal, as deposited (including tack welds if to be incorporated) will be free from cracks, slag, inclusions, gross porosity, cavities and other deposition faults. The weld metal will be properly fused with the parent metal without serious undercutting or overlapping at the toes of the weld. The surfaces of the weld will have a uniform and consistence contour and uniform appearance.

p) All weld runs found defective will be cut by using chipping hammer, gouging torch, or suitable grinding wheel in such a manner that adjacent material is not injured in any way. Peeling of the welds involving deformation of the weld surface either during de slagging or thereafter will not be allowed.

q) All welds will be 100% visually inspected to check the following:
   i. Presence of undercuts
   ii. Visually identifiable surface cracks in both welds and base metals.
   iii. Unfilled craters
   iv. Improper weld profile and size
   v. Excessive reinforcement in weld
   vi. Surface porosity

r) Before inspection, the surface of weld metal will be cleaned of all slag, spatter matter; scales etc. by using wire brush or chisel.

s) All the required NDT tests (like Dye Penetrant test, Ultrasonic test, Radiography test, etc…) shall be performed on all the weld joints as per relevant codes and standards after the completion of visual inspection of the weld joints.

3.2.15.3 Technical requirement for Staging, Galleries and Ladders

a) The civil works required for preparation of foundations of any new equipment(s) supplied by the bidder along with all required structures, supports, ladders, etc., are in the Bidder's scope.

b) The required structural columns, frame for the economizer, air pre-heater ducting and piping equipment, stair cases to steam generator drum level, soot blower locations, access openings shall be provided with liberally sized stairs, handrails and walkways.

c) The steam generator and its accessories will be provided with steel supporting structure made from rolled steel section or built-up sections where rolled sections are not available in India. These sections should have adequate strength for the loads imposed by the steam generator and associated equipments.

d) All gangways, passages, stair cases / ladders, working platforms and railing shall be provided. A clear working platform of 1000 mm to 1500 mm width is to be provided for steam generator at all levels, as per space available at site. All statutory requirements regarding staging, platform/stair cases etc. should be observed.
e) Two staircases on either side of the steam drum to be provided with suitable platform on the drum.

3.2.15.4 Technical requirement for Platforms and Walkways

a) Arrangement of platforms, walkways and landings shall provide safe access to all openings for inspection and cleaning purposes, permanent and test measuring points, control devices, local instruments, vents and drain valves, soot blowers, safety valves etc.
b) Platforms, walkways and stair cases shall be supported from unheated structures of steam generator or building and shall never be supported from pressure parts or other moving parts of the steam generator.
c) Platforms & walkway panels and stair treads shall be made of structural steel open bar gratings.
d) Minimum width of platforms and walkways shall be 1000 mm.
e) Minimum headroom above the top of platform or walkways should be 2200 mm.
f) Members supporting floor panel shall not deflect by more than 1/325 of the span.

3.2.15.5 Technical requirement for Stairs and Ladders

Scope of work related to existing staircase, ladders and handrails is not included in R&M scope. However, bidder needs to ensure any additional approach point and platforms necessary in line to the proposal is under the scope of the bidder.

3.2.15.6 Technical requirement for Grating For Platforms, Walkways And Stair Treads

a) Gratings shall be of structural steel with a minimum depth of 25mm and a minimum width of 750mm and shall conform to BS4952 Part I.
b) Minimum thickness of load bearing and spare bars shall be 3mm. Thickness of other binding bars shall be minimum 6mm.
c) Clear distance between the load bearing bars shall not exceed 40 mm. for diamond pattern and 30mm for rectangular pattern.
d) The deflection of grating panel shall not exceed span/200 or 10mm whichever is smaller.

3.2.15.7 Technical requirement for Handrails

a) Top rail, knee rail and vertical post shall be 32mm NB (medium) tube conforming to IS: 1239.
b) The spacing of vertical post shall not exceed 2.5 meters.
c) The height of handrail shall be 2.5 meter with rail at mid height.
d) At platform and landings toe guard of 100 x 5mm shall be provided.

3.2.16 Fans

3.2.16.1 Scanner Fans (2nos each / unit)

Scope of Work & Supply

Two numbers each of scanner air fans of suitable capacity for each unit is to be supplied along with ducting and civil foundation (if any) is in the scope of the bidder.

Technical Requirement

a) Two (2) 100%, one AC motor driven and the other DC motor driven scanner air fans shall also be provided for the flame scanner cooling. Power source shall be provided by owner, however DC Starter panel shall be provided by contractor.
b) The fan shall be horizontal, radial and with backward curved blades.
c) Isolation dampers to be provided at fan discharge.
d) The direction of rotation of all the similar fans shall be same.

e) The rotor of the fans shall be dynamically balanced and tested for its parameters at the works and test certificate and inspection certificate to be provided by the contractor. The rotor shall be dynamically re-balanced at site if the vibration levels, are found unacceptable.

3.2.16.2 Performance Requirements for Fans

a) All equipment and their accessories shall perform continuously with the levels of noise and vibration as specified below:
b) All equipment shall provide acceptable and not excessive back ground acoustical level. Measured noise level produced by any rotating equipment or a group of equipment closely located shall not exceed 85 db (A) at a distance of 1 m from it in any direction.
c) Vibration isolation of proven design shall be supplied by the contractor for preventing transmission of vibration from the equipment to other neighboring equipment and structures for all fans.

3.2.17 Fuel Oil System

Scope of Work & Supply

Fuel oil system should be compatible with the new PLC / DDCMIS based system and new burner system.

Repair / Replacement of oil gun during R & M and the requirement of new modified ignition systems for both coal and gas burners.

Technical Requirement

In case of replacement, the new oil burners shall be wide range air/ steam atomized type (as per site conditions) having turn down ratio 4:1 for each. This condition is stipulated to achieve minimum oil consumption for flame stabilization. The oil burners shall be complete with tips, extension pipes, burner shut-off valve, flexible hoses and accessories.

3.2.18 Insulation & Refractory

Scope of Work & Supply

The existing insulation, cladding and refractories of all the equipments in the Boiler scope shall be completely replaced with new material. The new insulation cladding and refractory shall be supplied and installed such that the skin casing temperature of any surface within the terminal points is not more than 60°C with ambient temperature of 50°C, surface air velocity of 0.25 meter/second, emissivity of aluminum cladding as 0.2 and the boiler operating at 100% BMCR.

Refractory provided in the burner opening, peephole, manhole, wall blowers openings, furnace bottom ash hopper also need replacement. The refractory in furnace second pass needs to be replaced.

Modified spring type sealing arrangement with better refractory system having plastic refractory material to avoid ash ingress is to be provided in to the pent house.

Technical Requirement

Thermal Insulation, Cladding and Refractory

General

The complete existing insulation, cladding and refractory on the boiler, ducting, critical piping, regenerative vessels and any other surfaces within this specification scope shall be totally replaced by the new refractory, insulation and aluminum cladding. The material for refractory and thermal insulation of the equipments, covered in this specification shall confirm to relevant Indian Standards unless otherwise specified. It shall also comply with all currently applicable statutes, regulations, and safety codes of the locality in which it is to be applied.

All the insulation material permanent or removable shall be designed for useful life of fifteen (15) years.

Mechanical integrity shall not be affected by vibrations of the equipment on which it is applied.

Design Criteria
The insulation thickness furnished shall be based on the following design condition (**in Table-3.5**).

Table-3.5: Design Criteria for Insulation

S.N.	Criteria	Design Condition
1	Ambient Temperature	50°C
2	Surface velocity	0.25 m/sec
3	Emissivity of Aluminum	0.2
4	Insulation surface temperature	ambient +10 (max)
5	Thermal conductivity	Not less than maximum values as per IS : 8183
6	Pipe/Equipment / boiler wall temperature	Max. fluid design Temp
7	Overall heat transfer coefficient & insulation thickness	To be calculated as per relevant codes and standards ASTM-C-680-89

The minimum insulation thickness, however, shall not be less than 75 mm for steam generator surfaces and 25 mm for other surfaces.

Codes & Standards
Material and application of insulation material, protective cladding, wire mesh etc. shall be confirming to latest edition of following Codes:
a) IS: 8183
b) IS: 3677
c) IS: 3144
d) IS: 14164
e) IS: 280
f) ASTM-B 209

Insulation Material
Material
Insulation material for all equipment, ducting etc. shall conform to following requirements

Parameters	Requirement
i. Material	a) Lightly resin bonded mineral wool with low halogen content of Best grade conforming to IS: 8183 (Handmade mattresses are not acceptable) b) Material shall be rock wool only. Slag wool shall not be accepted.
ii. Bulk density of lightly resin bonded mineral wool mattresses	a) For use up to 400°C - 100 kg/m^3 b) For use above 400°C - 150 kg/m^3

Physical Requirements
Following criteria shall be met by testing as per relevant clauses of IS: 3144.

a) Shot content: 5% by weight (max.) size of any shot not to exceed 5 mm.
b) Bulk Density: To comply with (i) & (ii) of **Codes & Standards** given above.
c) Weight gain by moisture absorption: 2% (max.)
d) Sulphur Content: Not exceeding 0.6%
e) Alkalinity as percentage of Na2O: Not exceeding 0.6%
f) Maximum oil content: Not exceeding 0.3% by weight.
g) Total Carbon content: Not exceeding 0.3% by weight
h) Settlement: Nil (when tested as per Cl. 22.0 of IS 3144)
i) Hand ability: Full hand able without any lump formation and disintegration of material
j) Loss by weight after combustibility test: Not exceeding 5% by weight.

The insulation mattress shall be incombustible when tested by the method prescribed in clause 15 of IS: 3144 and shall meet the requirement of the mercantile marine department, Lloyd's register of Shipping, underwriter, fire hazard codes and other international standards.

In addition to above requirements, insulation material (and protective covering) shall:

Be fresh incombustible, rust proof, non-hygroscopic,
a) Be capable of withstanding continuously and without deterioration the maximum temperature to which they will be subjected.
b) Not to react chemically, either to itself or with other components.
c) Not sustain any fungi or vermin and must not pose health hazards.

The mineral wool shall
a) Pass, standard combustibility test both immediately after application and after subjected to maximum operating temperature for not less than 100 hrs.
b) Not to suffer permanent deterioration as a result of contact with moisture due to condensation and shall be free from objectionable odor.
c) Not to cause corrosion of the surface being insulated or of cladding on it under normal site conditions.
d) Not to suffer any quality deterioration under specified service conditions (both cold/hot face temp.) of use.
e) The use of finishing materials containing asbestos in any form for insulation is not permitted.
f) Insulation mattress/section shall be supplied in thickness of 25, 40, 50 and 75 mm. Insulation of higher thickness shall be made up in multiple layers using mattress/slabs of thickness specified above. However, if the required thickness is such that by using above mattress/slabs the calculated thickness is not achieved, the mattress/slabs in increment of 25 mm shall be acceptable for outer layers. The min. thickness however, shall not be less than 25 mm and number of layers shall be minimum and innermost layer shall be thickest.

Sheeting Material
The Sheeting material for all insulated surfaces, equipment and piping as defined shall be aluminum, conforming to ASTM A-209-1060 temper H-14. or IS: 737. The thickness of aluminum sheeting to be used shall be as follows

Table-3.6: Sheeting Material thinness

S. No	Particulars	With Lightly bonded mattress	With pre formed pipe
a	For dia of insulated surface of 450 mm & above and for flat surfaces	16 SWG	—
b	For dia of insulated surfaces less than 450 mm	0.941 mm (20 SWG)	0.941 mm (20 SWG)
c	For Steam Generator outer casing	16 SWG - Ribbed	

S. No	Particulars	With Lightly bonded mattress	With pre formed pipe
		aluminum	

Binding and lacing Wires
Binding and lacing wires shall be provided in line with following **Table-3.7**.

Table-3.7: Binding and Lacing Wires

S No	Temperature range °C	Material	Thickness of wire
A	Up to 400	Galvanized Steel	20 SWG
B	Above 400	Stainless steel	20 SWG

Straps
Straps shall confirm to material given in the following Table-3.8.

Table-3.8: Straps

S No	Temperature range °C	Material
a	Up to 400	Galvanized Steel
b	Above 400	Stainless Steel

1. Straps shall be 20 mm wide and 0.6 mm thick
2. For securing Aluminum sheeting material, stainless steel or anodized aluminum bends shall be used.
3. Screws shall be Galvanized steel, check headed, self-tapping type.

Hexagonal wire Mesh
Hexagonal wire mesh shall be conforming to following details given below:

Table-3.9: Hexagonal Mesh

S No	Temperature range °C	Material	Size
a	Up to 400	Galvanized Steel	10-13mm aperture and wire size min. 0.71 mm
b	Above 400	Stainless steel	20 SWG

Non-metallic components like 3 mm thick millboard, aluminum pigment sealant, white glass cloth, insulating cement, neoprene washer shall be provided.

Application of Insulation
General
a) All surfaces to be insulated shall be cleaned of all foreign materials such as dirt, grease, rust etc. and shall be dry before the application of insulation.
b) Before applying the insulation the contractor shall check that all instrument tapping, clamps, lugs and other connections on the surface to be insulated have been properly installed as per the relevant erection drawing.
c) All flanged joints shall be insulated only after the final tightening and testing.
d) The insulation shall be applied to all surfaces when they are at ambient temp. Ample provision shall be made for the maximum possible thermal expansion and the insulation shall be applied to avoid breaking/telescoping due to alternate periods of expansion and contraction.

e) All cracks voids and depressions shall be filled with finishing cement, suitable for the equipment-operating temperature so as to form a smooth base for the application of cladding.

Application of Insulation on Piping

a) All vertical pipes shall be provided with the suitable insulation supports to prevent collapsing/crushing of insulation due to its self-weight. Support rings shall be provided on all vertical piping with a difference in elevation of 4 meter or above, and there shall not be more than 3 m straight length between support rings.
b) Longitudinal joints of insulation mattress sections of horizontal piping shall be on the bottom or at the sides of the pipe.
c) When more than one layer of insulation mattress/section is required on piping the circumferential joints on adjacent layers shall be staggered by at least 150 mm and longitudinal joints shall be staggered by at least 50 mm.
d) The mattress type insulation shall be formed to fit the pipe and applied with the mattress edges drawn together at the longitudinal joints and secured by lacing wire. Pipe section insulation shall be fitted on pipe using binding wires.
e) Where insulation is applied in two or more layers each layer of mattress shall be backed with hexagonal wire mesh. For the first layer of insulation and in case of single layer insulation, hexagonal wire mesh shall be provided on both the surface of the mattress.
f) The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation. Any gap in the insulation shall be filled with loose mineral wool or finishing cement.
g) Insulation mattress/section ends shall be terminated at a sufficient distance from the flanges to facilitate removal of bolts.
h) The insulation shall be held in place by fastening over with binding wire for insulation surface with diameter up to and including 550 mm and with metal bends for insulation surfaces with diameter over 550 mm. The fastening shall be done at intervals of not more than 250 mm except where specified otherwise. The ends of the binding wires shall be hooked and embedded in the insulation. The straps shall be mechanically stretched and fastened with metallic clamping seals of the same materials as the strap.
i) Insulation for application on bends and elbows shall be cut into mitred segments, sufficiently short to form a reasonably smooth internal surface. After the application of insulation material place, insulating cement shall be applied as required to obtain a smooth surface.
j) Weather hoods shall be provided for insulated piping passing through floors/walls.
k) All pipe attachments coming on horizontal pipes, inclined pipes and bends shall be insulated along with pipe such that there will be no insulation applied to hanger rod and the component connecting hanger rod to pipe attachment. All pipe attachments exposed to weather shall be provided with weatherproof covering.
l) Upstream of all drain lines and the lines connected to steam traps, shall be insulated up to and including first isolating valve for heat conservation. Rest of such lines such as downstream of the drain valves, traps etc. and other lines such as safety valve discharges, vents, etc. shall be insulated for personnel protection.

Application of Insulation on Valves & Fittings

a) All valves fittings and specialties shall be insulated with the same type and thickness of insulation as specified for the connected piping with the special provisions or exceptions as given below.
b) All valves and flanges shall be provided with removable box type of insulation covered with box fabricated from aluminum sheets of thickness same as the connected pipe cladding. Adjoining pipe insulation shall be beveled back to permit removal bolts and nuts. The portion of the valve which cannot be covered by box type insulation shall be filled by loose insulating material of packing density at least equal to that of the insulating material of adjoining pipe. The insulation for valves/flanges shall be applied after the finishing has been applied over

the connected piping. The cladding shall be applied in such a manner that the bonnet flange can be exposed easily without disturbing the complete insulation and cladding.

c) Flanges on lines having temperature up to and including 150 °C shall not be insulated.
d) Union shall not be insulated.
e) Expansion joints, metallic or rubber, shall not be insulated unless otherwise specifically indicated.
f) Safety valves shall be insulated.

Application of Insulation on Steam Generator and other flat surfaces and equipments

Insulation to various areas shall be applied as under.

S.N.	Insulation Area	Form of Insulation
(a)	SG surfaces, hot air and flue gas ducts	Mineral wool block or Mineral wool blankets
(b)	All other surfaces (not enclosed by boiler casing	Calcium silicate block or as per (a) above

Application of Insulation on Furnace

For the steam generator furnace, if provided with skin casing and the super heater, and economizer casings where cold-water wall are involved, a first covering of refractory material shall be applied to the external tube surface before the application of any further heat resistant insulating material.

Application of Insulation on Doors

The access doors and inspection doors in the boiler shall be lined with refractory material. The access doors in other portions of the steam generator e.g. pent house shall be insulated in a similar manner corresponding to any casing, flue-ducts or air ducts where such openings and access doors occur.

Mineral wool Blanket Insulation

a) Provide expanded metal or hexagonal wire mesh on both sides for single layer mattress and on first layer in case of multi-layer insulation, Subsequent layers of multi-layer insulation to have only one side wire netting.
b) The edges of adjacent blanket to be laced together, by appropriate lacing wire.
c) Any gap between joints between insulation layers shall be filled by loose mineral wool confirming to IS: 3677.
d) All insulation to be secured by 1.63 mm dia wire netting over blankets with ends of wire tightly twisted, and pressed in to insulation surface.
e) Impelling pins shall be placed on centers not exceeding 300 mm.

Air & Flue Gas Ducts

Air & Flue Gas ducts with external stiffeners shall have first layer of insulation between the stiffeners and a second layer of insulation over stiffeners so that stiffeners are also insulated and a level surface is achieved

Application of Metal Cladding

a) All insulated surface of steam generator, air heater, air & flue gas ducts, critical pipeline etc. shall be covered with aluminum cladding of 20 SWG.
b) Weatherproof flushing shall be installed where the panels intersect with columns and at other similar joints.
c) Removable insulated covers shall be provided over the manholes.

d) Asphalt and craft paper moisture barrier shall be provided to the aluminum cladding for outdoor application. Such moisture barriers shall be fixed to the inner surface of cladding or shall be connected to the outside surface of insulation before application of cladding.
e) Cladding on top surface of steam generator and ductwork and equipments shall be suitably reinforced to prevent damage by personnel walking thereon.
f) All cladding for outdoor application shall be with neoprene washers.
g) All openings and joints in outdoor cladding for piping connections, supports of access shall be suitably flushed and weather-proofed where such flashings or weather-proofing cannot effectively control the entry of moisture, then such openings and joints shall be weather-proofed by application of aluminum pigment sealer.
h) All insulation shall be protected by means of an outer covering of aluminum sheathing. All insulation/cladding joints shall be sealed and made effectively weather and waterproof. All flat surfaces shall be given suitable slope to prevent collection of pools of water on the cladding surface. All sheathing shall be protected internally by the application of two coats of bitumastic paint.
i) All longitudinal joints shall have a minimum overlap of 50 mm and shall be located at 45 degree or more below the horizontal for horizontal equipment. Joints shall be made with cheese headed self-tapping galvanized steel screws at 150 mm centers.
j) All circumferential joints shall have a minimum overlap of 100 mm and shall be held in position by stainless steel or anodized aluminum bands, stretched and clamped.
k) Removable box type cladding for valves and flanges shall be fitted on the connected pipe cladding, with bands.
l) Aluminum cladding shall not come directly into contact with either the equipment surface or with the supporting arrangement on the equipment surface. To this end, adequate layers of 3 mm thick ceramic board shall be provided between the cladding and any supporting arrangement equipment surface, and fitted with self-tapping screws/metal bands, as applicable.
m) For bends, fittings etc. the cladding shall be provided in segments as to ensure a smooth finish of the cladding.
n) For cladding on vertical pipes/equipment, provision for load take up shall be made at every 2 to 4 meters along pipe/equipment axis.
o) All joints shall be sealed with acrylic emulsion weather barrier.
p) Galvanic corrosion shall be prevented by carefully avoiding permanent contact of aluminum cladding with copper, copper alloys, tin, lead, nickel or nickel alloys including Monel metal.

Refractory

Material

The refractory material shall comply with relevant Indian Standards. The refractory selected shall ensure perfect sealing and shall have good thermal cycling properties allowing quick shut/shut down of steam generators.

The refractors material shall

a) Have high bulk density and minimum moisture content.
b) Be capable of withstanding service temperature of 1700 deg. C
c) Be resistant to slagging products due to coal, and to impurities of oil like V_2O_5, Fe_2O_3, K_2O_2, Na_2O etc. and to erosion due to fly ash.
d) Be chemically inactive towards alkalis, iron, or silica, shall pose no health hazard to working personnel, and shall not have any explosive properties.
e) Have sufficient strength to withstand forces generated in boiler, without any rupture or damage.

Application of Refractory

Application of refractory shall be such that:

a) To ensure perfect sealing, easy maintenance, minimum time for application.
b) To ensure minimum number of joints, all the joints to be filled and tightly packed with loose powder or same material.

4.0 TERMINAL POINTS & EXCLUSIONS

TERMINAL POINTS:

S. No	System	Description
Steam Generating Units		
1.	Service Water	1 m away from individual equipment in steam generator area.
2.	Instrument Air and Service Air	1 m away from boiler of Unit – 1 at 8 m level. Bidder shall provide quantity and quality of the compressed air to the owner.
3.	Cooling Water (CCW)	1 m away from individual equipments in steam generator area.
4.	HP Steam	Inlet of MSSV
5.	Water Spray Line for Superheater	1 m tapping from feed water line. All valves in the scope of Steam Generator package.
6.	Drains	Stub joints from header to blowdown tank.
7.	Boiler Blowdown	Connection of blowdown pipe on the drum
8.	Feed water	About 1 m away from the bottom economizer inlet header at left and right side.
9.	Vents	At safe elevation (1 m above roof)
10.	Coal	10 m from burner inlet.
11.	Fuel Oil	Outlet flange of the first isolating valve from common header for main line & first valve from recirculation header for recirculation line.
12.	BF Gas Pipe	Outlet flange of the BF Gas line isolating valve of each burner. Any new gas pipe, valves and dampers associated with implementation of Gas Firing Controls and its integration with PLC / DDCMIS system is under the scope of bidder.
13.	CO Gas Pipe	Tapping point from the common gas header in left and right side of Furnace first pass. Any new gas pipe, valves and dampers associated with implementation of Gas Firing Controls and its integration with PLC / DDCMIS system is under the scope of bidder.
14.	Secondary Air Duct	Tapping point from the common secondary air header in left and right side of the furnace first pass. Any new ducting, dampers, expansion bellows and actuators and its interfacing with PLC / DDCMIS system is under the scope of bidder.
15.	Flue gas ducting	Outlet of the first compensator of furnace exit.
16.	Atomizing Steam line	Outlet flange of the first isolating valve from common header & first valve from boiler drum for individual line.
17.	Gas purging steam line	Outlet flange of the first valve from the gas purging header in both side at burner floor.

EXCLUSIONS:-

Following are excluded from the scope of supply and services.

1. Steam Turbine

2. Generator
3. STG Building
4. Air Pre Heater
5. HP Dosing System
6. Electrostatic Precipitator
7. Coal and Ash Handling Plant
8. Entire Milling system including feeders, cyclone separator, PC bunker, Raw coal Bunkers, screw feeders, mill fan, etc...
9. FD Fan and ID Fan
10. Boiler Drum and internals
11. All electrical systems other than Scanner Fans (02 nos.) as per Clause no. 3.2.16.1, Page no. 43 of 116 of Volume – 2, Section – B of Technical Specification and actuators as per list provided by the owner which will be supplied by the bidder.
12. Water Treatment System
13. Air-conditioning and Ventilation System
14. Ambient Air Quality Monitoring
15. Illumination
16. Above ground and below ground earthing
17. Boiler Elevator
18. Firefighting system, unless otherwise specifically indicated.
19. Administrative Building
20. Communication system
21. Hydrogen Generation plant
22. Fuel oil Unloading & Forwarding Pumps and Tanks with piping.
23. Auxiliary steam piping
24. Civil works other than Scanner Fans (02 nos.) foundations as per Clause no. 3.2.16.1, Page 43 of 116), Volume – 2, Section – B of Technical Specification and any civil works related to installation and cabling for new panels in the control room which will be in scope of the bidder.

5.0 PERFORMANCE ASPECTS

PERFORMANCE ASPECTS

5.1 GENERAL

The term Performance Guarantee wherever appears in the technical specifications shall have the same meaning and shall be synonymous to “Functional Guarantees”

Volume 2, Sec-A, clause no. 9 “Tests” describes conditions in details for all the tests to be carried out.

The contractor after completion of the R&M work shall carry out the Trial operation /reliability run of the unit and after which Performance Guarantee test shall be carried out as per stipulated conditions herein and Volume 1 clause 9 and 10.

5.2 PERFORMANCE GUARANTEES

In the performance Guarantee test, Contractor has to prove the performance guarantee parameters within the shortfall limits as specified in the Commercial document.

Liquidated damages to be specified in the Commercial Document.

5.3 GENERAL REQUIREMENTS

The steam generator unit and auxiliaries shall be designed for maximum reliability and availability, operability and maintainability particularly in respect of the following:

All equipment and systems shall be of proven design, using proven materials with well-established physical and chemical properties and as appropriate to the service as intended.

The retrofitted steam generator unit and its auxiliaries shall be suitably designed and provided with required instrumentation for rapid starting, loading and unloading without causing undue vibration, distortion, differential expansion or producing excessive thermal stresses.

Start up curves for the re-engineered boiler is to be provided.

5.4 PERFORMANCE REQUIREMENTS

5.4.1 Steam generator Output

Following parameters are to be ensured and the same is to be declared in the Bid / data sheets.

1. Steaming capacity of minimum 210 TPH with firing design coal & gas (with minimum 50,000 Nm^3/hr BFG & 3,000 Nm^3/hr COG) and minimum 176 TPH by firing only design coal subject to the condition that
   (i) Main Steam pressure of 100 ± 1 ata after approximately two meters from the Stop Valve at the existing tapping point at 100% BMCR when firing coal and combination of coal and gas (BFG/COG) and
   (ii) Main Steam temperature of 540 ± 5 °C after approximately two meters from the Stop Valve at the existing tapping point at 100% BMCR when firing coal and combination of coal and gas (BFG/COG).

   The parameters specified are subject to further condition that in case of change in input parameters, suitable correction curves shall be applicable. The correction curves shall be applicable for the following parameters:
   i) Steam generation: Collector pressure (80-90 at) and temperature corrected.
   ii) Pressure: Main steam pressure shall be ensured by isolating the unit from the collector.

The tolerance / shortfall limit shall not be more than 10 TPH steam capacity decrease in either case.

5.4.2 Furnace Draft:

Following parameters are to be ensured and the same is to be declared in the Bid / data sheets.

Gas tight furnace with furnace vacuum of -4 mmWC (at reference level of 21 m) at all operating conditions for rated steam parameter of steam flow of minimum 176 TPH with design coal only (CV 3800 kCal/kg) and minimum 210 TPH with both coal & gas (BFG & COG) of 50,000 Nm^3/hr & 3,000 Nm^3/hr at 100 ata and 540 °C at superheater outlet.

5.4.3 Flue Gas Temperature at APH inlet

Flue gas temperature at APH top block inlet shall be between 384 °C and 395 °C and as per Table 3.1 and same shall be guaranteed for all loading conditions with design coal. If the Contractor is not able to achieve flue gas temperature at APH top block inlet within the specified limit within 90 days after conducting PG Test, the same shall be accepted with Liquidated Damages as mentioned in the Commercial document.

5.4.4 Unburnt Carbon in Fly Ash and Bottom Ash

i) Percentage Unburnt Carbon in Fly Ash shall not exceed 3%.
ii) Percentage Unburnt Carbon in Bottom Ash shall not exceed 5%.

These shall be guaranteed for all loading conditions with design coal.

5.5 PERFORMANCE GUARANTEE TEST

General Requirements

The Contractor shall guarantee that the equipment offered (supplied new as per this specification) for the Steam Generator after renovation shall meet the ratings and performance requirements. The Steam Generator shall be able to operate continuously and generate their full output after R&M and there shall be no restrictions in operations of these units, including base load, peak load and cyclic load operation. The design capabilities of the plant operations including cold / warm / hot start-ups after R&M shall in no way inferior to original design.

The guaranteed performance parameters furnished by the Bidder in his offer, shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures. After R&M the contractor shall conduct performance test and demonstrate all the guarantees covered under performance guarantees and performance requirements, as per the test procedures specified in the Vol-II at relevant clauses, and provisions mentioned in commercial documents.

REJECTION CLAUSE

Boiler steaming capacity:

In case the boiler steaming capacity falls below the required design figure as stated in the specification with design coal, and the contractor is not able to bring the boiler steaming capacity to the specified limit within 90 days after conducting PG test, the boiler will be rejected and boiler shall be taken back by the contractor and in such case, owner will recover all the payments (including taxes & duties) made by them to Contractor on account of the rejected boiler.

PERFORMANCE TESTS

- All performance guarantee tests shall be performed in accordance to the latest ASME-PTC.

- The final performance tests at site shall be conducted by the Bidder, in the presence of Owner, to demonstrate the guarantees as well as proper functioning of various equipments

and the availability of margins as designed in various equipments, and shall be binding on both the parties after successful demonstration of trial run.

- The Bidder's commissioning engineer shall make the plant ready for each such tests which shall commence within three (3) months after the plant and equipment have attained stable operation, at the end of trial operations or such extended periods, as may be mutually agreed upon.

- All the test instrumentation required for the performance and efficiency tests shall be supplied by the Bidder and shall be taken back by him upon satisfactory completion of all such tests at site. All the test instrumentation shall be calibrated by the Bidder from a recognized test institute, as approved by the Owner.

- All calibration standards and procedures shall be subject to Owner's approval. All costs associated with supply, calibration, installation, conductance of tests and return of test instrumentation shall be included. All the temperature test wells, pressure test connections and all other test connections and/or sampling methods shall conform to relevant ASME performance test codes and the Bidder shall fully elaborate the provisions made.

- Ambient conditions: - 35°C temperature (Dry bulb) and 60% relative humidity. The reference air temperature for the efficiency guarantee/ testing shall be taken as the temperature of air (i.e. 35°C) entering FD fans.

Notes:

- Performance tests shall be run at a time mutually agreeable to Owner and the Bidder as soon as tests can be practically scheduled, following written notice from the Bidder that the equipment furnished is ready for testing.

- Initial testing and any retesting required due to errors or omissions of the Bidder shall be at the Bidder's expense. Owner shall have access to test records during and after the test. A preliminary copy of all test data and report shall be promptly furnished to Owner within 18 working days after the test; and the final report shall be furnished to Owner within 20 calendar days after receipt of third party laboratory test results. Bidder shall expedite third party laboratory test results to the earliest delivery possible. The Bidder shall give written notice to Owner at least 30 days prior to the dates on which tests can be made.

- Acceptance of the equipment by Owner does not relieve the Bidder from any obligation or responsibilities arising under the guarantee and warranty provisions of this contract.

- Immediately prior to testing, the equipment shall be operated at a constant load within the control range long enough to minimize fluctuations in operating characteristics, such as pressure and temperatures. The rating shall be held constant during the test period. The duration of the test period shall be the minimum required for obtaining representative data.

- During the above, boiler testing program, the bidder along with the owner should ensure that boiler is able to generate 100% of the guaranteed steaming capacity.

- Procedures and techniques for the Bidder's tests shall be submitted to Owner including name of the item to be tested, location of measurement points, manufacturer and model number of major instruments to be used, any applicable correction curve(s) for off-design conditions, and a verifiable method of calculation of the test results. All the test procedures shall be approved from Owner’s end prior to actual tests.

- All temporary instrumentation for the tests shall be furnished by the Bidder including its installation and removal after satisfactory completion of the tests. Bidder shall list all temporary instrumentation in his test procedure.

- If the average steam temperature during the test period is lower than 538°C due to improper setting of the spray water controls, corrections shall be made to the steam temperature to account for spray water use. The Bidder and Owner shall coordinate efforts to ensure that controls are properly set. If the steam temperature level is not achieved during the test period; and the attemperator spray control valve is closed, the test shall be treated as a failure.

- The Bidder shall furnish correction curves, for Owner's approval, covering the expected ranges of variations for all the parameters.

- In all other aspects, not spelt out above, or in specifications, where ASME code stipulates agreement between the parties concerned before the test, the Bidder shall get these approved by the Owner.

- No negative tolerance on account of instrument inaccuracy or otherwise shall be allowed on the guaranteed values.

- Necessary performance test procedure, write-up, schemes, instruments schedules, detailed procedures clearly indicating periods of tests, frequency of observations, etc., shall be prepared and submitted for all the tests for Owner's review/approval.

6.0 PRE COMMISSIONING & COMMISSIONING ACTIVITIES

6.1 PRE COMMISSIONING ACTIVITIES

Scope of Work & Supply

Contractor's Scope shall include all pre-commissioning and commissioning activities, required for successful performance of all equipments and systems under this package and shall include, but will not be limited to, activities detailed in Technical Specification. Contractor scope shall also include supply of all materials and services including the following for successful conductance of pre-commissioning and commissioning activities.

Complete pre-commissioning work including tests of facilities such as hydraulic testing of pressure parts, air and gas tightness tests of steam generator enclosure, chemical cleaning of pressure parts , Boiler flushing , etc. and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.

The contractor shall submit all the commissioning procedures to the owner for approval before the commissioning of the unit.

Technical Requirements

Upon completion of erection / retrofitting of the equipments and systems contractor shall perform pre commissioning activities on the steam generator to make steam generators ready for safe, reliable, efficient and sustained operation. Pre commissioning activities of each steam generator shall generally include but shall not be limited to the following:

Hydraulic Testing of Pressure Parts

a) Hydraulic test to assess pressure withstanding capability of the pressure parts with all fittings and mountings in position shall be performed by the Contractor to satisfy the requirements of the Indian Boiler Regulations.
b) For conducting hydraulic test, the water shall be made alkaline by addition of suitable chemicals and after the test, water shall be suitably drained and the steam generator preserved.
c) All valves, high pressure piping along with interconnected pipes connecting the pressure parts as replaced, shall be subjected to hydraulic test along with the pressure parts within the scope of specification. All blank flanges or any removable plugs required for blocking the openings not closed by the valves and piping shall be furnished by the Contractor. Any defect/leakage noticed during the testing shall be rectified and the unit shall be retested by the Contractor.
d) The hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting authority as per the provision of the IBR and the engineer.

Air & Gas Tightness Test

After completion of all work on pressure parts and before application of any insulation, an air and gas tightness test shall be performed by the contractor to check and establish the gas tightness of the complete Steam Generator system from the outlet of FD fan through the steam generator to the air heater. The test shall be conducted for physical detection of leakage using fog generated by fogging machine. For this purpose complete system under testing shall be filled with fog and pressurized to a positive pressure of at least 100 mm WC. The fogging shall be continued during such pressurization. The leakage, if any, shall be detected visually. Any defect, noticed during such gas tightness tests shall be corrected and the unit retested. Chemicals used for fog generation shall be such that these do not have any adverse effect on the boiler parts exposed to it.

Chemical Cleaning of Pressure Parts

The Contractor shall perform thorough and efficient cleaning operations of all the internals of the boiler parts like economizer, water wall, feed water line, piping, start-up recirculation lines and

associated piping and all other pressure parts and associated high pressure piping covered under these specifications (except those portions which are to be steam blown).

The cleaning operation shall consist De-mineralized (DM) water flushing, the chemical cleaning using acids like hydrofluoric acid or as recommended by the manufacturer, DM water rinsing, DM water flushing, passivation, nitrogen capping etc. Complete chemical cleaning procedure, the scheme and layout including parameters of the pumps, size of tanks, materials of construction, the rate of consumption and total requirements of steam and water for such cleaning process need to be submitted prior to cleaning operation and shall be approved by the Owner.

The Contractor shall furnish all labour, materials such as the required chemicals and other consumables, all equipment such as acid transfer and acid circulating pumps complete with drive motors, acid storage and acid mixing tanks, all temporary piping, valves and specialties and local instruments for pressure, temperature and flow measurements and any other items needed to carry out the process. All equipment required for chemical cleaning of Steam Generator shall be supplied by the contractor.

The Owner will arrange to supply raw water and De-mineralized water required for the cleaning operations at the Terminal Points.

The procedure for hydraulic test, air and gas tightness test and cleaning and preservation of the boiler shall be submitted by the contractor for approval by the purchaser before conducting the pre commissioning test as per the specification.

The Contractor shall take care to dispose off used chemicals and the effluents from the cleaning operations, after neutralization, meeting all the statutory regulations and in a manner acceptable to the Owner. This includes construction of suitable neutralization pit, channels, disposal equipments etc.

The Contractor shall specifically make all necessary arrangements for prevention of any fire accidents, explosions etc. during the performance of the chemical cleaning operations.

The Contractor shall ensure that during the cleaning process the procedure adopted shall be such as to consume minimum de-mineralized water.

The cleaning procedure shall include final flushing and draining of the boiler under a nitrogen gas cap and / or filling the boiler with inhibited water or any other proven procedure recommended by the manufacturer for the preservation of the boiler, which is acceptable to the owner. The Contractor shall furnish a detailed procedure for boiler preservation during detailed engineering for Owner's approval.

All equipment needed for such preservation including the nitrogen cylinders, interconnecting piping and any regulating equipment for N2 cap and other preservatives shall be provided by the Contractor for the Steam Generator and the same shall also become the property of the Owner after completion of the chemical cleaning.

All the temporary equipments like pumps, tanks, piping etc. as mentioned above, brought on to Site by the Contractor for performing the chemical cleaning operation, on the completion of the cleaning operation of the unit and when no longer required shall be dismantled by the Contractor and shall remain the property of the Contractor.

The Contractor shall provide adequate safety and protective equipment for all his employees and ensure that they are worn at all times during working. Specialized treatment equipment (such as required for first aid when using hydrofluoric acid) for steam generators must be provided at the

place of handling acid. An acid cleaning report and log of each cleaning must be provided by the Contractor to the owner, immediately after the cleaning operation.

After completion of chemical cleaning, the bidder will inspect all the headers with boroscope for any foreign material and also check the internal condition for that the bidder will cut the hand-hole plates on the headers and the same will be repositioned by welding after inspection is over.

The bidder is supposed to provide the detail report for hydro test and chemical cleaning of the boiler to the customer.

Steam Blowing

The Contractor shall carryout the steam blowing for superheater tubes, superheater headers and superheater desuperheating spray water lines to clear any blockage, contamination etc. The fuel / DM water requirement for the steam blowing to be specified in the data sheet.

The Contractor will give recommended procedures, method of blowing, and scheme for steam blowing indicating clearly any additional system to be cleaned by steam blowing, other than the systems stated above.

The Contractor shall furnish his recommendations regarding termination/acceptance criteria for steam blowing, which, in any case, shall be approved by the Owner, based on acceptability of such criteria for 'Steam Turbine'.

The systems, which should be ready and operational before steam blowing and which are in the scope of the Contractor shall be made ready / operational by the Contractor by the scheduled date for starting of steam blowing.

Supply of spool pieces and / or blanks, as required, cutting / welding / edge preparation and re-welding required for blanking and replacing any instrument fitting valve etc. by spool pieces, will be the responsibility of the Contractor. In addition to this the supply and erection of all materials like temporary piping, its supports etc. required for complete steam blowing shall also be in the scope of the Contractor.

The steam generator and its accessories equipment shall be operated by the Owner under supervision of the Contractor to generate steam at the parameter and quality in line with the approved steam blowing procedure.

The 'Contractor' shall ensure successful and timely completion of steam blowing of all systems. The 'Contractor' will render all help / services as required during steam blowing, including series of test/operating personnel/supervision.

After successful completion of the steam blowing, all temporary piping/blanks/spool pieces etc. shall be removed and the system shall be restored back to normal, ready for further commissioning/operation.

Reliability Run

Once the initial operations are over, the Contractor shall notify that the unit is ready for Reliability Run. The plant will be put on Reliability Run when the Owner is fully satisfied that the offered Plant has been proven with regard to its safety. A 7 days' notice will be issued by the Contractor to the Owner about the completion of the Plant /Unit being ready for the Reliability Run. The duration of Reliability Run of the complete Unit in the automatic position of control system under varying load shall be fourteen (14) days, out of which at least seventy two (72) hours shall be in continuous operation on Full load at design parameters and design input as per Clause 3.1.4 &

3.1.5 of Technical Specification. This protocol will confirm the acceptance of the participating parties that all the Plant/ unit systems have been completed and are put in auto operation with all necessary adjustments and final testing of all controls and protections are made for operating over the full load range and the Plant/ Unit is ready for the Reliability run.

Other conditions for the reliability run shall be discussed and finalized between the owner, the contractor and any appointed /authorized agency of the Owner after completion of the initial operations.

6.2 COMMISSIONING AND INITIAL OPERATION OF THE FACILITIES

Scope of Work & Supply

Supply of all consumables (except coal and fuel oil for firing) like chemicals, nitrogen for blanketing, consumables for air / gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities.

Supply of all temporary equipments such as tanks, piping, including supports, valves, nitrogen blanketing equipments including nitrogen cylinders, pumps and all necessary instrumentation for successful conductance of pre-commissioning and commissioning activities.

The temporary equipments specifically brought by the Contractor solely for the pre-commissioning and commissioning work shall on completion of these activities, remain the property of the Contractor. However, the nitrogen blanketing equipment including nitrogen cylinders shall get included in the Contractor's permanent scope of supply and become property of the owner.

The selection of material of all the temporary equipments/ instruments shall be compatible with the service conditions expected during pre-commissioning/ commissioning activities.

All temporary equipments and instruments shall be clearly listed out in the bid.

Supply of all labour, skilled / semi-skilled technicians, supervisors, engineers and any other manpower required shall be under the scope of the bidder.

Technical Requirements

Commissioning Test / Checks

After completion of renovation work, the Contractor shall carryout commissioning checks at site on all the equipments and the systems that are supplied new or which were modified to ensure satisfactory performance of the equipment / system as whole and to check its integration with steam generator before commencement of trial run. The Contractor should prove the temperature difference between the Boiler outlet Main Steam Left and Right temperature within ±5ºC at rated load condition. The total Attemperator spray to control the boiler outlet temperature within limits shall also be specified in the data sheet and verified during the commissioning test.

7.0 SPARES

SPARES

General

The Contractor's scope shall include in his scope of supply all the necessary Start-up and commissioning spares and Recommended spares and indicate these in the relevant schedules of the Bid Forms & Price Schedules separately. The general requirements pertaining to the supply of these spares is given below:

7.1 RECOMMENDED SPARES

In addition to the spare parts mentioned above, the Contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Forms & Price Schedules. The owner reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.

Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the owner.

The Bidder to provide the list of recommended spares including price considered essential in the format provided in Annexure-IV.

7.2 START-UP & COMMISSIONING SPARES

Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the Plant is handed over to the owner shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

The Bidder shall include in his scope of supply, all the necessary Start-up and commissioning spares and indicate these in the relevant schedules of the Bid Forms & Price Schedules. The general requirements pertaining to the supply of these spares is given below:

The Contractor shall indicate the service expectancy period for the recommended spare parts under normal operating conditions before replacement is necessary.

All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desiccators packs as necessary.

The Contractor will provide owner with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the owner to identify and finalize order for recommended spares.

Each spare part shall be clearly marked or labeled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

All cases, containers or other packages are to be opened for such examination as may be considered necessary by the owner.

The Contractor will provide the owner with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipments covered under the Contract and will further ensure with his vendors that the owner, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract Documents and will be free from defects in design, material and workmanship.

In addition to the recommended spares listed by the Contractor, if the owner further identifies certain particular items of spares, the Contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the owner and placement of order for additional spares if the owner so desires.

The Contractor shall guarantee the long term availability of spares to the owner for the full life of the equipment covered under the Contract. The Contractor shall guarantee that before going out of production of spare parts of the equipment covered under the Contract, he shall give the owner at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to Sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his Sub-Contractors, Contractor will provide the owner, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the owner for the purpose of manufacture/procurement of such items.

8.0 BILL OF QUANTITIES

BILL OF QUANTITIES

The summarized List of Items to be supplied and quantities under the contract for Boiler (One unit) scope is as follows.

Sr. No	Item	Description of R&M job	Code	Quantity	Unit price CIP		Total price
	BOILER & ITS AUXILIARIES			**1**	**2**	**3**	**=1x3**
1.	Pressure Parts						
2.	Economizer	Minor need based modification of Economizer coil along with headers based on agreed scope of work		LOT			
3.	Water wall	i)Replacement of gooseneck bend tubes (complete)		100%			
		ii)Replacement of Burner panel tubes and top/ bottom bends		100%			
		iii)Replacement of Bottom “S” panel and cathouse tubes		100%			
		iv)Replacement of water wall tubes with membrane design with openings for soot blowers		100%			
4.	Ceiling Super heater	i) Complete replacement of roof tubes of fin design along with headers.		100%			
5.	Attemperator	i)Replacement of SH attemperator with higher capacity units		100%			
		ii) Capacities of super heater attemperator spray water systems to be designed for 15% of the rated main steam flow.					
6.	Convective I & II Superheater	Minor need based modification of superheater coil along with headers based on agreed scope of work		LOT			
7.	Valves	i) Retrofitting / replacement of the existing impulse type drum-safety valves in the existing arrangement and		100%			

Sr. No	Item	Description of R&M job	Code	Quantity	Unit price CIP		Total price
		replacement of the existing superheater impulse type safety valves with new spring loaded safety valves.					
		ii) Installation of silencers on the existing start-up vent valves		100%			
8.	Scanner air fan	The Scanner air fan with Motor, ducting, PLC / DDCMIS connectivity and other auxiliaries.		100% 2 sets			
9.	Pent house sealing	i) Modified spring type sealing arrangement with better refractory system having plastic refractory material to avoid ash ingress in to the pent house.		100%			
		ii) Replacement of pent house casing along with new insulation.		100%			
10.	Boiler Roof	Repair the boiler roof to new powder coated sheets		100%			
11.	Buck Stay	i) Replacement of buck stay and damaged railings floor grills etc as per modified furnace design		100%			
		ii) Buck stay including the corner fixing arrangement, sealing of gaps and refractory work is proposed to eliminate air ingress in this area.					
12.	Hangers & Supports	100% replacement of hangers and supports of the critical piping & furnace (Feed water & MS piping)		100%			
13.	Insulation &Refractory	i) Replacement of all insulation and cladding		100%			

Sr. No	Item	Description of R&M job	Code	Quantity	Unit price CIP		Total price
		of boiler, ducts, condensate and steam pipes. Replacement of all cladding sheets with aluminum sheets. ii)Replacement of Refractory for manholes, peep holes, burner opening & wall blower opening etc.					
14.	Ducts	Scope of repair / replacement of flue gas ducting and air ducting are covered in Annexure III: Overhauling scope of the technical specification and consequently shall not be in the scope of work of the Bidder. Material required to execute the overhauling job shall be provided by the owner. However, Secondary air ducting and dampers in the secondary air duct within the specified terminal points shall be in the scope of the bidder.		LOT			
15.	Dampers	Scope of repair / replacement of dampers are covered in Annexure – III: Overhauling scope of the technical specification and consequently shall not be in the scope of work of the Bidder. Material required to execute the overhauling job shall be provided by the owner. However, dampers in the secondary air duct within the specified terminal points shall be in the scope of the bidder.		LOT			
16.	Impulse lines	All impulse piping and root valves covered under the scope of new		100%			

Sr. No	Item	Description of R&M job	Code	Quantity	Unit price CIP		Total price
		BMS supply shall be in the scope of the bidder. However, for the existing system, length of the impulse piping for the purpose of quotation shall be provided by the owner. Over and above the specified value shall be on unit rate basis.					
17.	Burners and Ignition System	i) Replacement of existing multi fuel (Coal, oil & gas) coaxial burners with modified wall mounted low NOX separate / coaxial coal and gas (BF & CO) swirl burners with special long lasting burner tips		6 nos.			
		ii) Repair / replacement of oil gun as per O&M and the requirement of new modified ignition systems					
		iii) New secondary and fuel dampers with separate operational system to have flame optimization and combustion control to meet the variation in coal quality		100%			
		iv) Replacement of scanner ignitors (High Energy Arc Ignitor). Complete replacement for accommodating the new burner, new ignitors, new scanners and flame sensing camera.		100%			
18.	Upriser pipes	Upriser pipes are to be replaced completely.		100%			

Sr. No	Item	Description of R&M job	Code	Quantity	Unit price CIP		Total price
19.	Downcomer bends	The Bidder can reroute / replace the downcomers to accommodate their new design or can keep the existing pipes. In case of keeping the existing downcomers, the Bidder has to replace all downcomer bends.		100%			
	Civil						
20.	Boiler Foundation	Civil works for Scanner Fan (2 nos.) foundations as per Clause no. 3.2.16.1, Page no. 43 of 116, Volume – 2, Section – B of Technical Specification and any civil works related to installation and cabling for new panels in the control room, which will be in the scope of the bidder.		L.S.			
21.	Boiler Structure	Need based repair/ replacement of structural steel		Up to 200 MT and rest on unit rate basis			
22.	All other Foundation	Civil works for Scanner Fan (2 nos.) foundations as per Clause no. 3.2.16.1, Page no. 43 of 116, Volume – 2, Section – B of Technical Specification and any civil works related to installation and cabling for new panels in the control room, which will be in the scope of the bidder.					

9.0 DATA SHEETS

DATA SHEET-: DATA TO BE FILLED BY BIDDER

STEAM GENERATOR AND AUXILIARIES

SL. NO.	Description	Unit	Bidder's Note
1.1	Type of Steam generator / Furnace		
1.2	**Fuel required for :** • Startup / Warm-up • Flame stabilization • Load carrying		
1.3	Furnace Size (Width x Depth)	mm	
1.4	Furnace Chamber Volume	m^3	
1.5	Capacity at SG (BMCR)		
1.6	Drum (In case of replacement)		
	Drum: Internal dia x thickness, mm		
	Length, mm		
	Material, steel		
	Drum pressure (Ref. Note-1)	Ata (g)	115
1.7	Main steam pressure at Super heater outlet (Ref. Note-1)	Ata (g)	100
1.8	Main steam temperature Super heater outlet (Ref. Note-1)	°C	540
1.9	Flue gas temperature at air preheater top block inlet	°C	
1.10	Explosion force / Implosion		
1.11	Operation (Base load / constant. Pressure / sliding pressure)		
1.12	Code (IBR / ASME or any other equivalent international standard)		
1.13	Heat Release Rates (Ref. Note-2)		
1.13.1	Volumetric basis	$kcal/m^3/hr$	
1.13.2	Net heat Input to plan area (NHI / PA)	$kcal/m^2/hr$	
1.13.3	Burner Zone	$kcal/m^2/ hr$	
1.14	Gas Temp. at Furnace outlet at SGMCR (Ref. Note - 3)	°C	
1.15	NOx Emission limits (for coal firing)		
1.16	Unburnt combustibles in Bottom ash	%	
1.17	Unburnt combustibles in Fly ash	%	
1.18	Excess Air at APH inlet (20% maximum)	%	
1.19	Ambient temp. for performance test	°C	
1.20	Furnace tube arrangement (Membrane type)		
1.21	Type of tubes and header for pressure parts (Seamless)		
1.22	Flue gas velocity in SG second pass (≤ 10 m/s)	m/s	

NOTES:-

1.0 The value indicated is as required.
2.0 For calculating heat release rates:
- 2.1 The net heat is the effective heat in the furnace. This shall be calculated on the basis of the gross heating value (GHV) of the fuel corrected by subtracting radiation loss, unburnt combustible loss, latent heat of water in the fuel and adding the sensible heat in both the fuel and the combustion air above specified ambient temperature.
- 2.2 The volumetric heat release shall be calculated by dividing the NH by the net furnace volume (The net furnace volume shall be reckoned up to furnace outlet plane). Bidder shall furnish the method that bidder uses to calculate the net furnace volume, in his bid.
- 2.3 Plan area shall be obtained by multiplying the width with the depth of the furnace.
- 2.4 Burner zone heat release rate shall be obtained by dividing net heat by 2 x (furnace width + furnace depth) x burner zone height, where burner zone height is equal to (vertical distance between top and bottom row burners + 3 meters).

3.0 Furnace exit gas temperature is the temperature of flue gas at furnace outlet plane. Bidder shall furnish a sketch of the furnace indicating the furnace outlet plane with relevant dimensions of the furnace.

		Unit	**100%BMCR**	**60% BMCR**
1.0	**PERFORMANCE DATA**			
1.1	**Load Data**	**MW**		
1.1.1	Steam flow from Superheater	T/hr		
1.1.2	Superheater Desuperheating spray water flow	Kg/hr		
1.1.3	Steam flow for soot blowing, oil burner atomization etc.,	T/hr		
1.2	**Calculated Flow Quantities**	**Kg/hr.**		
1.2.1	Total air to Air Preheater (APH) inlet			
1.2.2	Air leakage thru APH			
1.2.3	Air at APH outlet			
1.2.4	Total secondary air			
1.2.5	Flue gas at APH inlet			
1.2.6	Flue gas at APH outlet			
1.2.7	Coal firing: a) With Design Coal			
	b) With Worst Coal			
1.2.8	FD fan outlet air			
1.2.9	Hot air at mill inlet			
1.2.10	ID fan inlet flue gas			
1.2.11	Tempering air for each pulverizer			
1.2.12	Total air to each pulverizer			
1.3	**Steam/Water Pressure& Pressure Drops, Kg/cm2g**			

		Unit	100%BMCR	60% BMCR
1.3.1	Steam at Superheater outlet			
1.3.2	Pressure drop in Superheater(s)			
1.3.3	Steam in Boiler Drum			
1.3.4	Pressure drop in Economizer*.			
1.3.5	Water at Economizer inlet **			
1.4	**Steam/Water Temperature**	**deg. C**		
1.4.1	Steam at Superheater outlet			
1.4.2	Water at Economizer inlet			
1.4.3	Water at Economizer outlet			
1.5	**Flue Gas Temperature**	**deg. C**		
1.5.1	Theoretical Combustion Zone			
1.5.2	Furnace Exit			
1.5.3	Low temperature Superheater Inlet			
1.5.4	Low temperature Superheater Outlet			
1.5.5	Platen Superheater Inlet			
1.5.6	Platen Superheater Outlet			
1.5.7	Secondary Superheater (Convective II) Inlet			
1.5.8	Secondary Superheater (Convective II) Outlet			
1.5.9	Primary Superheater (Convective I) Inlet			
1.5.10	Primary Superheater (Convective II) Outlet			
1.5.11	Economizer Inlet			
1.5.12	Economizer Outlet			
1.5.13	APH Inlet			
1.5.14	APH Outlet (uncorrected)			
1.5.15	APH Outlet (corrected)			
1.5.16	Electrostatic Precipitator Inlet			
1.5.17	Electrostatic Precipitator Outlet			
1.5.18	I.D. Fan Inlet			
1.5.19	I.D. Fan Outlet			
1.6	**Air Temperature**	**deg. C**		
1.6.1	FD fan inlet			
1.6.2	Air at APH Inlet			
1.6.3	Air at APH Outlet			
1.6.4	Secondary air at burner inlet			
1.6.5	Coal air mixture at Pulverizer outlet			
1.6.6	Coal air mixture at burner inlet			

		Unit	100%BMCR	60% BMCR
1.7	**Air Pressure Drops Secondary air**	**mm WG**		
1.7.1	FD fan inlet duct			
1.7.2	FD fan outlet			
1.7.3	Air heater inlet			
1.7.4	Air heater outlet			
1.7.5	Mill inlet			
1.7.6	Mill outlet			
1.7.7	PF Pipe from Mill Fan discharge to Furnace			
1.8	**Flue Gas Pressure & Pressure Drops**	**mm WG**		
1.8.1	Furnace pressure			
1.8.2	Drop Across Superheater			
1.8.3	Drop Across Economizer			
1.8.4	Drop Across APH (gas side)			
1.8.5	Drop Across Electrostatic Precipitator (ESP)			
1.8.6	Drop thru' Ducts & Dampers from-			
	a) APH outlet to ESP Inlet			
	b) ESP outlet to ID fan Inlet			
	c) ID fan outlet to Stack Inlet			
1.8.7	Total drop through the system			
1.9	**Excess Air**	**(%)**		
1.9.1	At Burners			
1.9.2	At Furnace Exit			
1.9.3	At Economizer Outlet			
1.9.4	At APH Outlet			
1.9.5	At ID fan Inlet			
1.10	**Percentage load change per minute without exceeding the limits on unburnt combustibles or NO_X while maintaining safe flame conditions**			
1.11	**Time required for draining the complete steam generator**			
1.12	**Acid dew point temp. adopted**	**deg. C**		
1.12.1	For Design Coal Firing			
1.12.2	Worst Coal Firing			
1.13	**Flue gas velocities**	**m/Sec.**		

		Unit	100%BMCR	60% BMCR
1.13.1	In Superheater Section			
1.13.2	In Economizer Section			
1.13.3	In APH inlet			
1.13.4	In Ducts			
1.13.5	ESP inlet			
1.14	**Percentage of Oxygen in Flue Gas**			
1.14.1	At Furnace exit			
1.14.2	At Economizer outlet			
1.14.3	At APH inlet			
1.15	**Heat Absorbed per Unit Weight of Coal Fired**	**Kcal/ Kg.**		
1.15.1	In Economizer with-			
	a) Design Coal			
	b) Worst Coal			
1.15.2	In Superheater with -			
	a) Design Coal			
	b) Worst Coal			
1.15.3	In Water Walls with -			
	a) Design Coal			
	b) Worst Coal			
1.15.4	Total heat absorbed			
	a) Design Coal			
	b) Worst Coal			
1.16	**Losses and Efficiency**	**%**		
1.16.1	Standard/Code as per which the losses & efficiency will be measured			
1.16.2	Moisture in fuel loss for :			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.3	Hydrogen in fuel loss for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.4	Moisture in Air loss for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.5	Unburnt Combustible Loss for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.6	Radiation loss for			

		Unit	100%BMCR	60% BMCR
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.7	Dry gas loss for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.8	Unaccounted loss for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.9	Other losses (if any) for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.10	Total losses for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.11	Heat Credits considered for the following items (to be filled in by Bidder)			
	a) …….			
	b) …….			
	c) …….			
1.16.12	Total Heat Credit for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.13	Efficiency for			
	a) Design Coal firing			
	b) Worst Coal firing			
1.16.14	Calculations for losses, heat credit and efficiency (to be furnished by Bidder)			
	a) Design Coal firing			
	b) Worst Coal firing			
1.17	**Energy Quantities**	**Kcal / hr.**		
1.17.1	Energy to Steam & Water			
1.17.2	Heat output of unit			
1.17.3	Heat input from fuel			
1.17.4	Furnace dimension (L × B × H)	mm		
1.17.5	Net heat input per m3 of Furnace volume	Kcal/ hr/m^3		
1.17.6	Maximum net heat input per m2 of furnace plan area	Kcal/hr/m^2		
1.17.7	Maximum Burner Zone heat release rate	Kcal/hr/m^2		
1.17.8	Maximum heat liberation rate	Kcal/hr/m^2		
1.17.9	Maximum heat input/ burner	Kcal/hr		
1.17.10	Maximum furnace Cooling factor	Kcal/hr/m^2		

		Unit	100%BMCR	60% BMCR
1.17.11	Minimum furnace residence time	Sec		
1.18	**Particulate matter concentration**			
1.18.1	Particulate concentration at ESP inlet for			
	a) Design Coal firing	g / Nm^3		
	b) Worst Coal firing	g / Nm^3		
	c) Chemical Quantity for dosing	Kg/hr		
1.19	**Distribution of Ash**	**(Kg/hr.)**		
1.19.1	Furnace bottom hoppers with			
	a) Design Coal			
	b) Worst Coal			
1.19.2	Economizer hoppers with			
	a) Design Coal			
	b) Worst Coal			
1.19.3	APH hoppers with			
	a) Design Coal			
	b) Worst Coal			
1.19.4	Any other hoppers with			
	a) Design Coal			
	b) Worst Coal			
1.20	**Instrument and Service Air Requirement for the Boiler & auxiliaries**			
1.20.1	Quantity	m^3/min.		
1.20.2	Pressure	Kg/cm^2 (g)		
1.21	**Purity of saturated steam leaving the drum**	**ppm**		
1.21.1	Total dissolved solids			
1.21.2	Silica content			
1.21.3	Sodium			
1.21.4	Chlorides			
1.21.5	Copper			
1.21.6	Iron			
1.21.7	Moisture			
1.22	**Waterwall**			
1.22.1	Type			
1.22.2	Number of tubes			
1.22.3	Design tube thickness, mm	mm		
1.22.4	Outside diameter, mm			
1.22.5	Actual thickness used, mm			

		Unit	100%BMCR	60% BMCR
1.22.6	Margin on tube thickness over and above pressure requirement, mm			
1.22.7	Tube Pitch, mm			
1.22.8	Material specification and composition			
1.22.9	Effective heating surface area M^2			
1.22.10	Maximum steam side metal temperature, deg.C			
1.22.11	Maximum gas side metal temperature, deg.C			
1.22.12	Number and type of thermocouple fittings			
1.22.13	Material of water wall support (composition)			
1.22.14	Number of headers			
1.22.15	Header dimension (Dia. x thickness)	mm		
1.22.16	Number of buckstay (Specific for each elevation)			
1.22.17	Dimension for the buckstay			
1.22.18	Type of support for water wall			
1.23	**Superheater**			
1.23.1	Type (Radiant / convection)			
1.23.2	Platen (drainable / non-drainable)			
1.23.3	Horizontal headers (drainable / non-drainable)			
1.23.4	Material specification and composition			
1.23.5	Effective heating surface area M^2			
1.23.6	Total circumferential heating surface area, M^2			
1.23.7	Gas flow path area, M^2			
1.23.8	Heat Absorption, (×106 kcal/h)			
1.23.9	Depth of each bank in the direction of the gas flow, mm			
1.23.10	Maximum average gas velocity (m/sec)			
1.23.11	Tube Pitch(Across/Parallel) to gas flow, mm			
1.23.12	Clear space between the two banks in the direction of gas flow, mm			
1.23.13	Maximum steam side metal temperature, deg.C			
1.23.14	Maximum gas side metal temperature, deg.C			
1.23.15	Number and type of thermocouple fittings			
1.23.16	Type of flow (counter or parallel)			
1.23.17	Material of tube support (composition)			
1.23.18	Design standard			

		Unit	100%BMCR	60% BMCR
1.23.19	Design tube thickness, mm			
1.23.20	Outside diameter, mm			
1.23.21	Actual thickness used, mm			
1.23.22	Margin on tube thickness over and above pressure requirement, mm			
1.23.23	Number of elements/section			
1.23.24	Total number of tubes replaced			
1.24	**Headers: Superheater**			
1.24.1	Material specification			
1.24.2	Location (outside/inside gas path)			
1.24.3	Number of headers			
1.24.4	Maximum operating pressure	Kg/cm^2 (g)		
1.24.5	Design pressure	Kg/cm^2 (g)		
1.24.6	Design temperature	°C		
1.24.7	Design standard			
1.24.8	Outside diameter	mm		
1.24.9	Thickness	mm		
1.24.10	Whether any diaphragm is used in any header and if so give details			
1.24.11	Details of final outlet header connection			
1.24.12	Method of internal inspection			
1.24.13	Total volume	M^3		
1.24.14	Maximum header unbalance			
1.25	**Superheater Temperature Control**			
1.25.1	Attemperator Superheater			
	a. Type			
	b. Number of stages of Attemperation			
	c. Position in steam circuit			
	d. Size of desuperheater header	mm		
	e. Specification of material			
	f. Superheater steam temperature range that can be maintained between 60% to 100% of Boiler MCR,	deg. C		
	g. Spray nozzle material			
	h. Maximum spray water flow rate and corresponding steam output,	T/hr		
	i. Minimum spray water rate and corresponding steam output	T/hr		
1.26	**Safety Valves**			
1.26.1	**Drum**			

		Unit	100%BMCR	60% BMCR
	Type			
	Number			
	Set Pressure (Open)	$kg/cm^2(g)$		
	Set Pressure (Close)	$kg/cm^2(g)$		
	Blowdown ratio	%		
	Relieving Capacity	Kg/hr		
	Total Relieving Capacity	Kg/hr		
	Percentage of BMCR flow	%		
1.26.2	**Super heater**			
	Type			
	Number			
	Set Pressure (Open)	$kg/cm^2(g)$		
	Set Pressure (Close)	$kg/cm^2(g)$		
	Blowdown ratio	%		
	Relieving Capacity	Kg/hr		
	Total Relieving Capacity	Kg/hr		
	Percentage of BMCR flow	%		
1.27	**Piping, Valves and Specialities for Critical (external) Piping**			
1.27.1	Pipes & Fittings			
1.27.2	Basic codes and standards for design fabrication and erection testing and inspection			
1.27.3	Welding of piping			
	Type of weld			
	Special electrode details (type, quantity)			
	Number of welds envisaged for each piping covered in this specification			
1.28	**Economizer**			
1.28.1	Type (Plain, drainable, non-steaming)			
1.28.2	Material specification and composition			
1.28.3	Manufacturer			
1.28.4	Water side effective heating surface area	M^2		
1.28.5	Gas side effective heating surface area	M^2		
1.28.6	Gas flow path area	M^2		
1.28.7	Heat transfer co-efficient (gas to water) at 100% BMCR	$Kcal/M^2/ hr$		
1.28.8	Provisions made for economizer on load cleaning			
1.28.9	Details of recirculating system			
1.28.10	Design pressure of tubes	kg/cm^2 (g)		

		Unit	100%BMCR	60% BMCR
1.28.11	Design temperature of tubes	°C		
1.28.12	Minimum allowable feed water temperature	°C		
1.28.13	Outside diameter of tubes	mm		
1.28.14	Number of headers			
1.28.15	Header dimension (Dia. x thickness)	mm		
2.0	**FLUE GAS TEMPERATURE AT AIR HEATER TOP BLOCK INLET**	**deg.C**		

		Unit	Forced Draft Fans	Induced Draft Fans
3.0	**DRAFT FANS considered in calculations**			
3.1	Capacity (flow rate for each fan)	NM^3/hr		
	a. At 100% Boiler BMCR			
	b. Max flow rate the fan can handle			
	c. Min flow rate the fan can handle			
	d. Fan critical speed	rpm		
	e. Coupling type between fan and motor			
3.2	Static Pressure	mmWC		
	a. At 100% Boiler BMCR			
	i) For fan inlet			
	ii) For fan outlet			
	b. Min safe pressure			
3.3	Design margin provided			
	a. Flow rate %			
	b. Static pressure %			
3.4	Density of air/gas at working temperature	Kg/Cm^3		
3.5	Fan efficiency at			
	a. Design (Test block) condition			
	b. 100% BMCR			
	c. 60% Boiler MCR			
3.6	Power Consumption	KW		
	a. At 100% Boiler MCR			
	b. At 60% Boiler MCR			
	c. Shaft HP at 100% Boiler MCR			
3.7	Features of Construction			
	a. Blades provided with renewable wearing noses?	Yes/No		
	b. Mode of adjustment of gas/air flow control			
3.8	Lube Oil System			
	a. Number of pumps per fan			

		Unit	Forced Draft Fans	Induced Draft Fans
	b. Number of pumps in standby / service			
	c. Type of pump			
	d. Number of oil cooler per fan			
	e. Number of oil coolers in standby /service			
	f. Relief valves provided?	Yes/No		
	g. Pressure switches provided?	Yes/No		
	h. Thermometers provided?	Yes/No		
	i. Electric heaters with oil tanks provided?	Yes/No		
	j. Quantity of Cooling water required	(T/hr)		
3.9	Accessories			
	a. Type of coupling provided			
	b. Coupling guards provided?	Yes/No		
	c. Base plate and foundation bolts provided?	Yes/No		
	d. Forced lubrication unit with pumps, filters, coolers, connected piping etc. provided?	Yes/No		
	e. Local instruments provided?	Yes/No		
	f. Provision for vibration sensors made?	Yes/No		
	g. RTDs for fan and motor bearings provided?	Yes/No		
3.10	Minimum load of fan at which it can operate in parallel without any knocking and bumping			
4.0	**PULVERIZED COAL BURNERS**			
4.1	Type			
4.2	Make			
4.3	Number of coal burners fed by each pulverizer			
4.4	Number of elevations of burners			
4.5	Number of burners per elevation			
4.6	Total number of coal burners			
4.7	Number of coal burners in operation from 20% to 100% Boiler MCR, their locations and tilt (if applicable)			
4.8	Design data			
	a. Temperature of coal air mixture		deg.C	
	b. Maximum allowable temperature of burners		deg.C	
	c. Turn down ratio			
	d. Temperature of hot secondary combustion air		deg.C	
	e. Capacity of each burner at			
	i) 100% Boiler MCR			
	ii) 92.2% Boiler MCR			

		Unit	Forced Draft Fans	Induced Draft Fans
	iii) Maximum			
	f. Type of combustion air entry			
	g. Pressure drop in the coal burner		mmWC	
	h. Velocity of coal air mixture at entry to burner		m/s	
	i. Log mean density of coal air mixture			
	j. Critical coal air fall out velocity and corresponding load			
	k. Velocity of secondary air at entry to burner		m/s	
	l. If burner tilt offered in degrees		Yes/No	
	m. Number & type of burner tilt drives (if applicable)			
	n. Percentage of excess air at the burner			
4.9	Construction features			
	a. Angle of fuel entry (fixed/ variable)			
	b. Cooling device (while in operation/idle)			
	c. Provision of measurement of burner metal tip temperature			
	d. Mode of adjustment of combustion air			
4.10	Materials of construction			
	a. Coal burner nozzle			
	b. Guide plates			
	c. Drive liner			
	d. Connecting liner			
	e. Air damper			
	f. Support bearing inside wind box			
	g. Connecting bar			
	h. Level			
4.11	Whether the following accessories provided			
	a. Drive for tilting coal burners?		Yes/No	
	b. Flexible connection between coal pipe and burner?		Yes/No	
	c. Position indicator for all dampers?		Yes/No	
	d. Limit switches?		Yes/No	
	e. Drive for air damper?		Yes/No	
4.12	Codes and Standards applicable			
			Unit	**Gas Burners**
5.0	**GAS-BURNERS**			
5.1	Gas Burners			
5.1.1	Manufacturer			
5.1.2	Type			
5.1.3	Design data			
	a. Number of gas burners			

		Unit	Forced Draft Fans	Induced Draft Fans
	b. Elevation of boiler burners (if applicable)			
	c. Number of burners per elevation (if applicable)			
	d. Scavenging medium			
	e. Duration of scavenging			
	f. Parameters of scavenging medium			
	g. Temperature of gas at burner inlet		deg.C	
	h. Maximum / minimum gas pressure range required at burners		Kg/cm^2g	
	i. Turndown ratio			
	j. Capacity of each burner		Kg/hr	
	k. Percent Boiler MCR capacity that can be carried by			
	i. All the burners			
	ii. One single burner			
5.1.4	Construction features			
	a. Angle of fuel oil entry (fixed/variable)			
	b. Mode of adjustment of combustion air			
	c. Type of diffuser			
	d. Type of cooling/ sealing device			
	e. Type of drive for each oil burner for insertion/retraction			
5.1.5	Materials of construction			
	a. Gas burner mixing plate/ spray plate			
	b. Guard pipe			
	c. Diffuser			
	d. Concentric tubes			
	e. Clamp			
	f. Gaskets			
	g. Flexible tubing			
	h. Burner body			
	i. Burner tip			
5.1.6	Whether the following accessories provided			
	a. Limit switches		Yes/No	
	b. Clamps		Yes/No	
	c. Gaskets		Yes/No	
	d. Flexible hose		Yes/No	
	e. Insertion, retract facility		Yes/No	
	f. Position indicators		Yes/No	
	g. Inbuilt flame scanner		Yes/No	
	h. Separate inlet for different fuels		Yes/No	
	i. Flow regulator		Yes/No	
	j. Flow meter		Yes/No	

		Unit	Forced Draft Fans	Induced Draft Fans
	k. Safety valves		Yes/No	
5.1.7	Codes and Standards applicable			
5.2	Gas Ignition System			
5.2.1	Codes and Standards applicable			
5.2.2	Type			
5.2.3	Number of ignitors			
5.2.4	Number of spare ignitors			
5.2.5	Heat input per ignitor		Kcal/hr	
5.2.6	Retractable or stationary?			
5.2.7	If ignitors are offered then following data shall be furnished			
	a. Whether suitable for firing both BF & CO gas / Furnace oil?		Yes/No	
	b. Electrode material			
	c. Expected life of electrodes			
	d. Experience list of bidder for similar igniters furnished?		Yes/No	
			Unit	**HFO / LSHS Burners**
6.0	**OIL-BURNERS**			
6.1	Oil Burners			
6.1.1	Manufacturer			
6.1.2	Type			
6.1.3	Design data			
	a. Number of oil burners			
	b. Elevation of boiler burners (if applicable)			
	c. Number of burners per elevation (if applicable)			
	d. Atomizing medium and its temperature			
	e. Scavenging medium			
	f. Duration of scavenging			
	g. Parameters of scavenging medium			
	h. Temperature of oil at burner inlet		deg.C	
	i. Atomizing steam parameter			
	- Maximum flow rate		Kg/hr	
	- Maximum / minimum steam pressure range required for atomizing		Kg/cm^2g	
	j. Maximum / minimum oil pressure range required at burners		Kg/cm^2g	
	k. Turndown ratio			
	l. Oil viscosity before the burners		Centistokes	

		Unit	Forced Draft Fans	Induced Draft Fans
	m. Combustion air temperature		deg.C	
	n. Capacity of each burner		Kg/hr	
	o. Percent Boiler MCR below which oil gun is required for flame stabilization.			
	i. All the burners			
	ii. One single burner			
6.1.4	Construction features			
	a. Angle of fuel oil entry (fixed/variable)			
	b. Mode of adjustment of combustion air			
	c. Type of diffuser			
	d. Type of cooling/ sealing device			
	e. Type of drive for each oil burner for insertion/retraction			
6.1.5	Materials of construction			
	a. Oil burner mixing plate/ spray plate			
	b. Guard pipe			
	c. Diffuser			
	d. Concentric tubes			
	e. Clamp			
	f. Gaskets			
	g. Flexible tubing			
	h. Burner body			
	i. Burner tip			
6.1.6	Whether the following accessories provided			
	a. Limit switches		Yes/No	
	b. Clamps		Yes/No	
	c. Gaskets		Yes/No	
	d. Flexible hose		Yes/No	
	e. Insertion, retract facility		Yes/No	
	f. Position indicators		Yes/No	
6.1.7	Codes and Standards applicable			
6.2	Oil Ignition System			
6.2.1	Codes and Standards applicable			
6.2.2	Type (high energy are ignitors)			
6.2.3	Number of ignitors			
6.2.4	Ignitor spark rate per minute			
6.2.5	Number of spare ignitors			
6.2.6	Heat input per ignitor		Kcal/hr	
6.2.7	Retractable or stationary?			
6.2.8	If high energy arc ignitors are offered then following			

		Unit	Forced Draft Fans	Induced Draft Fans
	data shall be furnished			
	a. Whether suitable for firing both HFO/LSHS?		Yes/No	
	b. Electrode material			
	c. Expected life of electrodes			
	d. Experience list of bidder for similar igniters furnished?		Yes/No	
			Unit	**Parameter**
7	**THERMAL INSULATION** (For the area mentioned in the specification)			
7.1	Insulating materials			
7.1.1	Type of insulating material(s)			
7.1.2	Manufacturer's name			
7.1.3	Maximum temp(deg.C) the insulating materials can withstand			
7.1.4	Insulating materials standard			
7.1.5	Density of insulating materials		Kg/M^3	
7.1.6	Thermal conductivity (Kcal/M/hr deg.C) at mean temperature of			
	a. 50 deg.C			
	b. 100 deg.C			
	c. 150 deg.C			
	d. 200 deg.C			
	e. 250 deg.C			
	f. 300 deg.C			
	g. 350 deg.C			
7.1.7	Resistance to micro-organism		Yes/No	
7.1.8	Incombustibility		Yes/No	

		Unit	Mineral fiber mattress (mm/Qty)	Pourable insulation (mm/ Qty)	Segmented Cement blocked calcium silicate (mm/ Qty)	Al sheet jacket (mm/ Qty)	Other (specify details) (mm/ Qty)
7.2	Steam Generating Plant & Auxiliaries, Insulation & Casing details						
7.2.1	Furnace extended side backpass walls						
7.2.2	Enclosure						
	a. Roof						

		Unit	Mineral fiber mattress (mm/Qty)	Pourable insulation (mm/ Qty)	Segmented Cement blocked calcium silicate (mm/ Qty)	Al sheet jacket (mm/ Qty)	Other (specify details) (mm/ Qty)
	i) Horizontal						
	ii) Vertical						
	b. Extended side						
	i) Horizontal						
	ii) Vertical						
	c. Bottom						
	i) Horizontal						
	ii) Vertical						
7.2.3	Any other (give details) area including auxiliaries and ducting etc.						
7.3	ID fans with drives						
7.4	Fan duct						
7.5	Platforms and rails						
7.6	Supporting structure for fuel gas system						
7.7	Dampers/vanes with actuators						
7.8	Fabricated components for insulation of flue gas system						
7.9	Other (list down items)						
7.10	Total weight of the package						

		Unit		
8	**GENERAL TECHNICAL INFORMATION DATA, DRAWINGS TO BE FURNISHED ALONGWITH PROPOSAL**			
8.1	Performance Data No. of Reference Drg./Leaflet/Write-up			
8.1.1	Boiler efficiency Vs load			
8.1.2	Characteristic curves showing the variation of superheated with load clearly indicating the regime of attemperation			
8.1.3	Characteristic curves of Steam Generating unit showing variations in efficiency, steam temperature and pressure with loads, for coal firing			
8.1.4	Correction curves for Steam Generator			

		Unit		
	efficiency for variation in parameters such as			
	a. Load			
	b. Superheater outlet pressure			
	c. Superheater outlet temperature			
	d. Feed water inlet temperature			
	e. Excess air			
	f. Humidity			
	g. With variation in coal quality parameters from those stated			
	h. Flue gas temperature at air heater outlet			
	i. Ambient air temperature			
8.1.5	ID fan blade angle lines; stall lines equal efficiency lines; and system resistance lines for all ID fans and Electrostatic Precipitator sections in service and also with one ID fan and one Electrostatic Precipitator section out of service both at 50 Hz and 47.5 respectively showing the BMCR and test block points, for both one fan and two fan operation.			
8.1.6	Furnace oil & gas burners output characteristics			
8.1.7	Characteristic curves showing the acid & dew point temperature Vs. sulphur content, moisture content in the coal and percentage of excess air			
8.1.8	Characteristic curves of the SH Spray attemperator			
9	**STEAM BLOWING REQUIREMENTS**			
	• Coal in MT • Furnace oil in kilo liters • Raw Water in cum. • Start up power in kWh and peak in kVA			
10	**COMMISSIONING REQUIREMENTS**			
	• Coal in MT • Furnace oil in kilo liters • Raw Water in cum. • Start up power in kWh and peak in kVA			

GUARANTEED PERFORMANCE PARTICULARS AND DATA

		Unit		
1.	Guaranteed Capacity of Steam Generator at rated pressure and temperature			
2.	Furnace draft at guaranteed operating condition			
3.	Minimum boiler load for flame stability only with coal firing (without oil support)			
4.	Furnace pressure with combined coal and gas firing at 100 %BMCR			
5.	Boiler Superheater steam temperature from 60% to100% Boiler MCR	deg.C		
6.	Steam purity and wetness			
7.	Flue gas temperature at APH top block inlet			
8.	NO_X emission should not exceed 260 gm of NO_X per gigajoules			

10.0 DRAWINGS AND DOCUMENTS

GENERAL

All I.B.R. test certificates required to be submitted to the Boiler directorate/chief inspector of Jharkhand and all approvals to be obtained by the Bidder. It shall be the responsibility of the Bidder to provide all necessary information / documentation / follow up and arrange inspection of the Boiler Inspector.

Single line drawing to be provided by Bidder will include: 3 element drum level control, furnace draft control, steam temperature control etc. Bidder will provide P & I drawings, GA, plot plan, etc. Detailed list of drawings for information / approval to be finalized, during kick-off meeting.

All the drawings shall be approved and vetted by the Owner /their Consultants.

All drawings which are to be approved and finally approved drawings, instruction and maintenance manuals of all equipments and other details will be handed over as under before commissioning.

6 sets for the Owner including soft copy on CD.
2 sets for the consultants to the Owner including soft copy on CD.

The Bidder shall submit all major drawings for approval, as well as a drawing list from which the Owner/Consultant will select those drawings which they consider necessary for completion of drawing approval. Before starting manufacturing of the equipment, the Bidder shall have to take approval of the design drawings from the Owner/Consultant. Any manufacturing done prior to approval of the drawings shall be rectified in accordance with approved drawings by the Bidder at his own cost, if any discrepancy arises and the equipment shall be supplied within stipulated period.

General Arrangement drawing shall be submitted for approval to the Owner/Consultant prior to the commencement of detailed engineering by the Bidder. These drawings shall show to scale, location and all major equipment including electrical. Equipment and overall dimensions as well as tie-in dimensions and clearances shall be clearly indicated.

The Bidder will be required to furnish all the necessary drawings data, etc. of the plant/equipment with appropriate ‘status” stamp in adequate number of copies as indicated below:

Sr. No	Status of the drawing / document etc.	No. of copies for Owner	No. of copies for Consultant
1.	Reference/information	2 prints	2 prints
2.	For approval	2 prints	3 prints
3.	Final & certified duly signed	4 prints & 1 reproducible soft copy in CD	2 prints
4.	Operation maintenance manual	3 copies + CD	1 CD
5.	Performance & acceptance test procedure	2 copies	2 copies
6.	All other documents	3 copies	2 copies

The Bidder shall submit copies of all drawings which are required to be approved by the Owner/Consultant. The drawings which are approved by the Owner/Consultant shall not be deviated from.

The drawings submitted by the Bidder for approval shall contain all information regarding the manner in which equipment is going to be located and all the loading data for the civil foundation. The drawing should show details of piping and electrical connections to be made by the Owner/Consultant for connecting the Bidder's equipment in the system.

The operating & maintenance instruction and the erection procedures together with drawings of the equipment as completed shall be in sufficient detail to enable to Owner to properly erect/install the equipment, to maintain, dismantle, reassemble and adjust all parts of the equipment.

The manuals shall give step-to-step procedures for all operations likely to be carried out during the life of the plant/equipment including during erection, commissioning, testing, operation & maintenance, dismantling and repair.

The manuals shall also contain copies of approved drawings as well as the performance/rating curves and copies of test certificates, if applicable. The maintenance instructions shall include the lubrication procedures, periodicity of lubrication as well as the brands of Indian lubricants to be used to ensure trouble free operation.

Indicative list of drawings to be submitted are given below. The final list including classification for information / approval will be finalized during the kick-off meeting.

The following data/documents, along with the bid except that the items marked ***** to be furnished after the contract is awarded on the successful bidder.

Sl. no	Description	Whether required
1.	Documents in support of the successful performance record of plant & equipment, similar to those being proposed now, which have been supplied & installed by the bidder in the past	Yes
2.	Similar documents as above from the bidder's sub-vendors (for sub- vendors to be selected after the award of EPC contract)	*
3.	Detail schedule for supply , erection & commissioning	Yes
4.	General arrangement drawing for steam generator up to stack indicating major dimensions and elevations	Yes
5.	Tentative dimensional figure for the proposed furnace along with the EPRS and volumetric heat release rate at different zones.	Yes
6.	The detail documents along with the calculation supporting description at Sl. No. 4 of this table are to be supplied during contract stage.	*
7.	General arrangement drawing for furnace elevation, side elevation, and cross-section of the steam generating unit showing location of headers and drums.	Yes
8.	General arrangement for furnace fire and illumination system	*
9.	Piping and instrumentation diagram for Steam & water system	Yes
10.	Piping and instrumentation diagram for Air and flue gas system	Yes
11.	Boiler performance data sheet	*
12.	Main steam line pressure drop calculation	*
13.	Piping line list	*
14.	Thermal insulation schedule (for piping & boiler)	*
15.	Scheme of steam and water showing instrument tap-off points	*

Sl. no	Description	Whether required
16.	Scheme of air and gas path with instrument tap off points	*
17.	Scheme of fuel gas supply and burning system with instrumentation	*
18.	Cold start up, warm start up (Overnight shutdown) and hot start-up curves.	*
19.	Correction curves	*
20.	Description of supply and firing system including associated equipment and drawings	*
21.	Details combustion calculations	*
22.	Equipment general arrangement drawing for : ID Fan Air and flue gas duct drawing Scanner air fan Ignitor air fan Coal & gas firing system Boiler Pressure parts Boiler structure Boiler Seal trough Any other equipment modification	*
23.	Technical specifications for ID Fan including fans blade angle lines, stall line, equal efficiency line, system resistance line with all fans in service from 47.5 Hz to 52.5 Hz respectively showing SGMCR & test block points, for both one fan and two fan operation as applicable.	*
24.	Technical specifications for Scanner air and ignitor air fan	*
25.	Technical specifications for Boiler safety valve (Drum & SH) & blow down valves	*
26.	Utility requirements	*
27.	Design basis for boiler structural	*
28.	Isometric drawings for critical piping	*
29.	Quality Assurance/Quality Control document as relevant to his proposal	Yes
30.	Manufacturing quality plan , Quality assurance plan & field quality plan for all bidder supplies	*
31.	Bidder's total plan (schedule, duration & frequency) on the regular maintenance work of the proposed plant, also describing how the owner personnel will be trained and utilized in the work	*
32.	Bidder's complete list of all technical deviations a) Commercial requirements of this bid b) Conditions of contract	 Yes Yes
33.	A Complete list of the Internationally accepted codes & standards which the bidder will follow in the design, material selection, manufacturing, erection, tests at works and tests at site	Yes
34.	B Bar-chart for the bidder's proposed design, manufacturing, procurement and delivery activities	Yes
35.	Complete list of all tests to be carried out, with code/standard followed and brief description of test procedure, for a) Tests at works b) Tests during erection & commissioning. c) Operational & flexibility tests d) Reliability demonstration tests	* * * *
36.	Acceptance tests	*
37.	Extended performance tests	*

Sl. no	Description	Whether required
38.	List of spares	Yes
39.	Consumable spares (for day to day maintenance, inspection & overhaul of plant & equipment requiring regular attention)	*
40.	Overhaul spares (for planned overhauls to ensure the required availability)	*
41.	Strategic spares (generally high cost and/or long lead-time spares required infrequently, may be once in the plant's life time)	*
42.	Manufacturing drawings for those spare parts going out of production beyond three (3) years of plant operation	*
43.	Engineering and master drawing schedule indicating when the drawings and data will be submitted for review within four (4) weeks from the date of issue of notice of proceed	*
44.	As build drawings of the equipments and system supplied	*

Note:

a) The Bidder may note that the drawings, data and manuals listed are minimum requirement only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted with his bid.

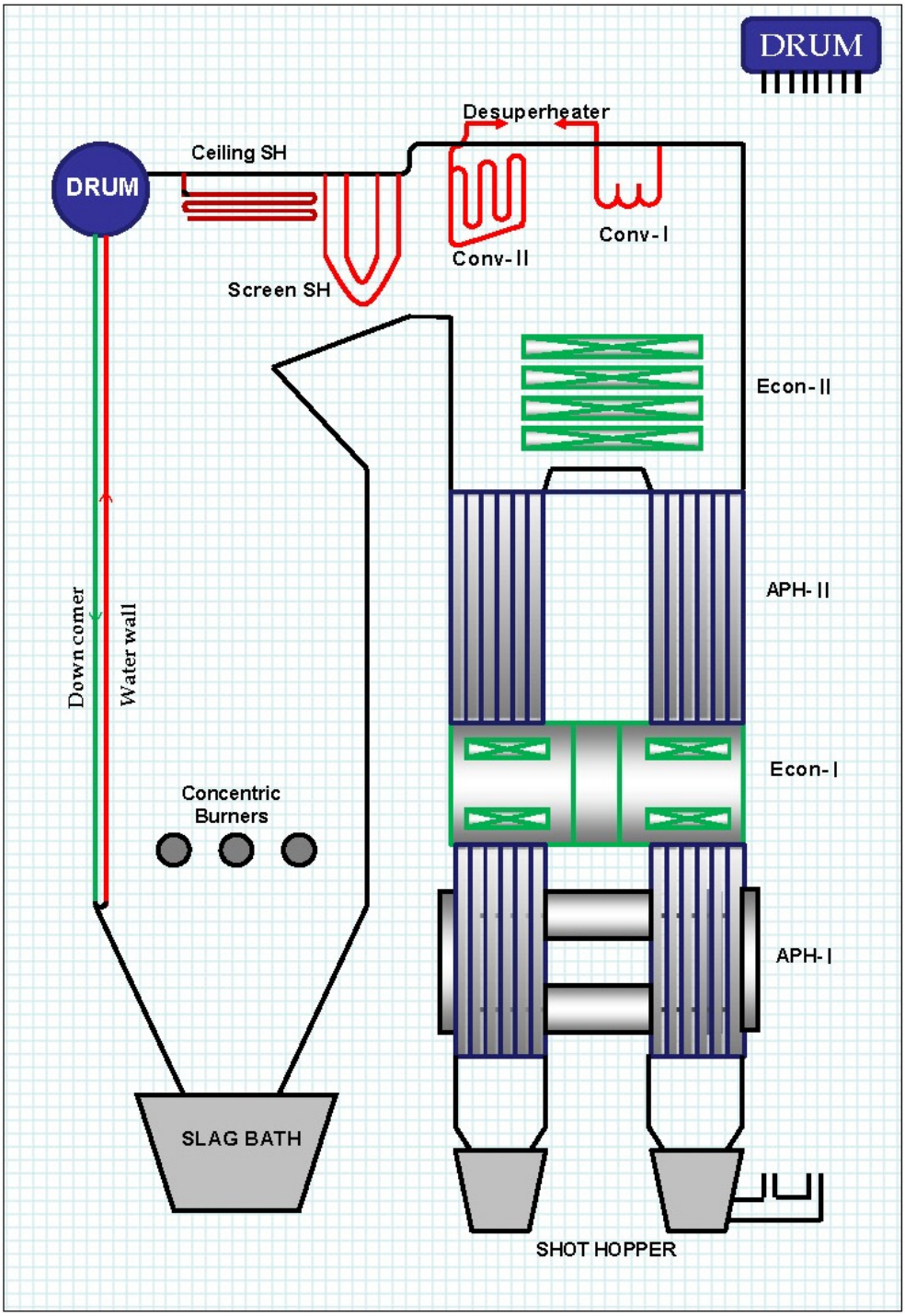
b) All drawings shall be prepared by using AutoCAD and documents shall be generated using Electronic version. The paper copy of the drawings & document shall be submitted for approval & reference. All final drawings and documents shall be submitted in CD in AutoCAD 2000 and MS office format as applicable for Owner's future reference.

c) All drawings and documents along with QAP should be submitted for approval & consent.

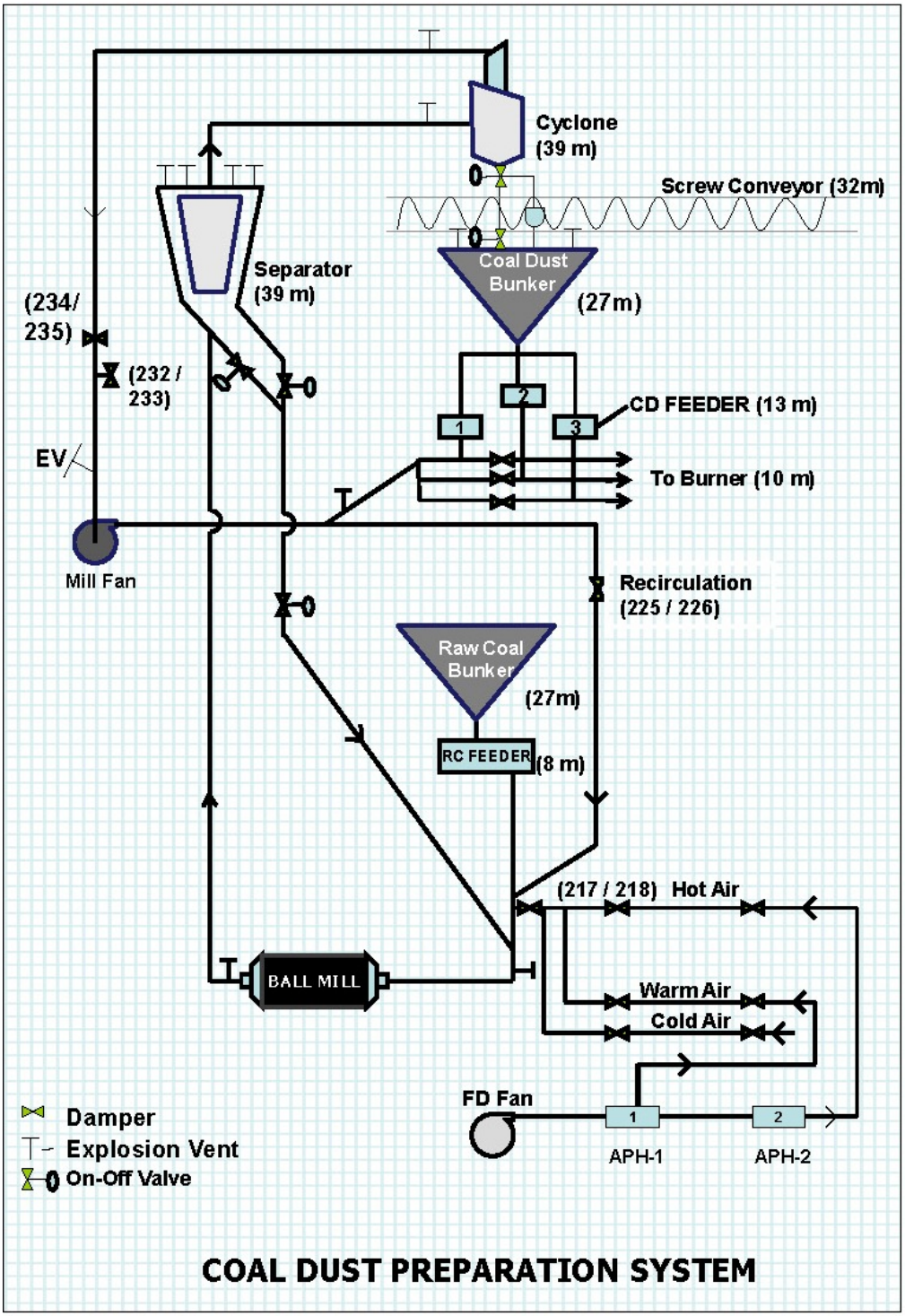
d) Bidders must arrange all IBR drawings duly approved by boiler inspectorate.

11.0 ANNEXURES

ANNEXURE-I: SCHEMATIC FOR STEAM GENERATOR



ANNEXURE-II: SCHEMATIC FOR THE MILLING SYSTEM



ANNEXURE-III: OVERHAULING SCOPE

Overhauling / Revisioning /Repair of equipments and parts (HP, LP) other than those covered in R & M part.

Scope of Work

Item no – 1
Ball mill

1. Opening of suction and discharge spout including air blaster if any then removing & shorting of balls & shifting the old & worn-out balls to scrap yard.
2. Repair of suction & discharge spout body, repair includes changing of damaged liners, spout rings & inspection doors.
3. Removal of old pinion assembly with its pedestal, clearing of pinion foundations frame, positioning of pedestal with new pinion assembly & alignment with girth gear & gear box.
4. Repair / replacement of worn-out Trunion ring of suction & discharge side.
5. Inspections, removal & replacement of damaged radial and axial drum liners. Tightening of all drums liners bolts after providing wedges and tack welds all bolts wherever necessary. Liners are to be cut, grinded & matched. Shifting of old / damaged liners to scrap yard.
6. Repair of damaged shell plate of drum (16mm thick) with new plates. Repair includes gas cutting and welding.
7. Inspection of gear box, cleaning and thorough inspection of cooling coils etc. replacement of worn-out parts if any, assembly of gear box after tightness checking of bearings. Positioning of gear box and alignment.
8. Repair / replacement of pinion foundation frame by removing old one & fixing new one.
9. Rectification of suction & discharge end cover flanges, rectification of flange gap by removing foreign materials.
10. Removal & assembly of suction & delivery end covers if required for rectification, same is to be done fixing each end covers.
11. Replacement / reversal of girth gear tightening of all segment bolts, parting plane bolts, check run out of girth gear & fix control bolt after reaming and tack weld all bolts. Grinding of teeth, if needed.
12. Repair / replacement of reducer foundation frame.
13. Inspection of suction & delivery bearings. Repair / replacement of damaged brigs. Matching of bearings with drum journal, replacement of oil indicator & all cooling lines. Clean all oil distributor headers.
14. Repair / changing of suction pipe (including compensator & explosion vent) from R. C. feeder to Ball Mill up to spout-
    i. dia 1020 x 6 mm
    ii. dia 600 x 6 mm
15. Shifting of new balls to site & loading them into the mill.
16. Fixing of suction & discharge spout.
17. Replacement of discharge end pipe (up to 8'M floor) by changing of damaged pipe (dia 1100 x 6 mm) including compensators & explosion vents. Pipe piece changing as per requirement up to separator. Concrete breaking & re-casting as per need.
18. Alignment of HT motor, reducer & pinion.
19. Coupling of pinion & reducer and reducer & motor.
20. Repair/replacement of all cooling water pipes and associated valves.
21. Trial run and liquidation of defects.

Item No – 2
Mill fan

1. Dismantling & assembly of :-

a) Reducer of **diameter 1100mm, L-1m**
b) Impeller.
c) Casing with delivery pipe up to terminal point of R&M.
d) Shaft assembly with bearings, housing & gauge glass.
e) Foundation frame including its pedestal assembly / matching.
f) Cooling coils to be tested, if damaged to be changed / repaired.

2. Explosion vents inspection / repair.
3. Delivery/ Suction duct inspection and repair/replacement.
4. Alignment of HT motor.
5. Trial run balancing and liquidation of defects.

Item No – 3
Capital repair of F. D. Fans

1. Casings to be repaired with repair /replacement of discharge compensator.
2. Impeller to be inspected. Defects to be attended / replacement of impeller.
3. Shaft to be inspected, repaired / replaced.
4. Bearing housing to be inspected. Repaired / replacement as per the need.
5. All bearing end covers to be repaired / replaced.
6. Coupling to be replaced, if needed.
7. Cooling coil and cooling water pipe lines along with the valves to be repaired / replaced.
8. Both suction and discharge dampers to be repaired and made operative.
9. Oil topping in the bearing hauling if any leakage persists is to be attended.
10. Cleaning of the area and shifting of scraps to scrap yard.
11. Static balancing of Impeller.
12. Alignment of HT motor.
13. Trial run and liquidation of defects.

Item No – 4
Secondary air dampers & ducts

1. Complete replacement of secondary air duct from FD Fan discharge via bottom and top APH ring header and outlet duct up to the terminal point of R&M of air duct and BM inlet.
2. Replacement of all compensators in the above mentioned secondary air path.

Item No – 5
Cyclone & Separator of Mill System

1. Complete replacement of 1100 mm dia Ball Mill Discharge pipes from BM discharge up to separator and from cyclone up to Mill Fan suction. Replacement of all compensators in this line.
2. Replacement of separator cone. Braking of concrete and re casting as per requirement.
3. Complete replacement of the plates of cyclone.
4. Replacement of connecting pipe of separator to cyclone along with replacement of compensators.
5. Replacement of bottom pipes of separators cones dia 290 mm.
6. Replacement of mill fan suction dampers.
7. Replacement / Revisioning of atmospheric suction damper of mill system.
8. Revisioning of on-off valves including modification of inspection holes & repair of pipes.
9. Overhauling & making free of separators link, vanes & its sector assembly, broken links are to be replaced.
10. Changing of damaged explosion vents of cyclones and separators.
11. Scaffolding making & removal as per need.

Item No – 6
Coal dust pipes of Mill System

1. Complete replacement of bends, straight pipes, dampers, compensators, etc., from Mill Fan discharge up to the terminal point of R&M of coal pipes.
2. Scaffolding making & removal as per need.

Hot, warm & cold air dampers

Replacement/repair of all hot, warm and cold air dampers in the mill system.

Item No – 7
Ducts & Compensators of Flue gas path

1. Replacement of compensator and plates in the flue gas duct from shot hopper to ESP inlet.
2. Repair of compensator and replacement of plates in the duct from ESP outlet to ID fan inlet.
3. Repair of furnace explosion vent & its duct.
4. Complete replacement of cover plates of 2nd pass bottom hoppers (04 Nos.)

Item No – 8
Seal Pot and platforms
Seal Pot

1. Revisioning of Seal pots (03 Nos.)
2. Changing of drain pipe of size 60 x 5 mm. and bends.
3. Replacement / revisioning of valves: (Φ 80 mm, 50 mm, 20 mm)

Platform

1. Repair/replacement of platform and stair case along with railing all around the Boiler from 0'M to 32'M.
2. Repair/replacement of platform of BF & CO gas line at 16'M, 21'M & 27'M along with their railing.
3. Repairing / replacement of PBD platforms along with stair cases.

Item No – 9
Gas line valves

1. Dismantling of dia 600 mm. hermetically sealed dumpers & gear box from position of CO & BF gas line at 16 M and 27 M level. The wt. of each damper is about 200 kg.
2. Revisioning/replacement of dampers (Dia 600 mm)
   i) Revisioning of dampers involves making shaft free / changing replacing the rubber flap/seal, changing of stopper bolts, brackets & spring.
   ii) Replacement of damper involves shifting of new dampers from store to site and shifting of old dampers to scrap yard as per direction of site In- charge.
3. Assembly of dampers and gear boxes after revisioning.
4. Revisioning of bleeder valves of size dia 80 mm.
5. Rev. / replacement of hermetically sealed dampers of BF gas line (size dia 1200mm).
   i) Revisioning of dampers involves making shaft free / changing replacing the rubber flap/seal, changing of stopper bolts, brackets, spring & revisioning of its gear box.
   ii) Replacement of damper involves shifting of new dampers from store to site and shifting of old dampers to scrap yard as per direction of site In- charge.
6. Revisioning / replacement of regulating dampers size dia 1200 mm. the job involve making dampers free.

i) Revisioning of dampers involves making shaft free / changing replacing the rubber flap/seal, changing of stopper bolts, brackets & spring.
ii) Replacement of damper involves shifting of new dampers from store to site and shifting of old dampers to scrap yard as per direction of site In-charge.

7. Cleaning of duct pipe at 16 M level of B. F. gas line, pipe size dia 1200mm.

Item No – 10
Gas Line Job

1. Incorporation of modern technology hydraulic sealing system in place of existing sector gate system for blanking and de-blanking purpose in BF and CO gas line. Modification of platform, erection of new structure and supports for hydraulic sealing as per requirements.
2. Replacement of BF and CO gas line from T joints at 16 m up to terminal points of R&M of BF Gas line.
3. Replacement of BF and CO gas line bends by fabrication of the same and straight pipe of CO line at 16 m level up to terminal points of R&M.

Item No – 11
Overhauling of drum

1. Opening of drum manholes. Cleaning & assembly after repair of drum. The manholes holding should be leak proof in hyd. test.
2. Plugging of drum inside about 52 Nos. and removal after repair (plugs will be supplied by BPSCL).
3. Changing of gasket of drum cyclone. gas cutting and removing the keys of flanges and again fixing after gasket positioning and tack welding of key.
4. Repair / positioning of filter trays & filter plates by cutting & welding.
5. Inspection and choking removal of all sampling lines, CBD lines and phosphate dozing line.

Item No – 12
Overhauling of HP & LP Valves

A. H. P. Valve

1. Dismantling of Valves.
2. Repair / replacement of spindle, valve's seat & discs, lapping of sheet as per requirements.
3. Revisioning of stuffing boxes including new inner & outer gland packing.
4. Changing of bushes & bearings.
5. Revisioning of gear boxes including changing of internal & bearings as per requirement.
6. Final assembly & oil topping in gear boxes.
7. Checking of the operation of valves.

Lists of valves to be serviced

S.N	Description of Valves	Valve Size	Valve No.	Quantity
1.	Main Steam Valve	273 x 18	252	01
2.	Super Heater Blow Down Valve	100 x 12	255 / 256	02
3.	Feed Line Valve	100 x 12	324 / 372	02
4.	Feed Line Valve	175 x 16	323 / 371	02
5.	Feed Line Valve	76 x 8	325 / 227	02
6.	Feeds Check Valve	175 x 16	FC Valve	01

7.	Feed Line NRV (Non Return Valve)	175 x 16	NRV	01
8.	Armature Valve / Eco. Drain Valve / DM Line Valve	76 x 8	--	10
9.	EBD Valve	65 x 8	257 / 258	02
10.	Drum Mountings, Vents, Drain Valves, Sample Line Valves etc.	25 x 4 / 10 x 2	--	175

Note: Payment will be done on the basis of actual No.

Job involves:

1. Dismantling of valves.
2. Repair / replacement of spindle, valve's seat & discs, lapping of sheet as per requirements.
3. Revisioning of stuffing boxes including new inner & outer gland packing.
4. Changing of bushes & bearing.
5. Revisioning of gear boxes including changing of internal & bearings as per requirement.
6. Final assembly & oil topping in gear boxes.
7. Checking of the operation of valves.

B. L. P. Valve

1. Changing of spiral gasket / seretted rings
2. Changing of all flange & gland bolts
3. Repair/replacement of spindles, bushes & new gland packing.
4. Repair /replacement of operating wheels
5. Final checking of the operation of valves.

Lists of valves to be serviced

S.N	Description of Valves	Valve Size	Valve No.	Quantity
1.	purging and drains valves	25 x 4 / 40 x 6	--	50
2.	Cooling water Line Valves	25 x 4 / 40 x 6	--	50

Note: Payment will be done on the basis of actual no.

Job involves:

1. Changing of spiral gasket / seretted rings.
2. Changing of all flange & gland bolts.
3. Repair / replacement of spindles, bushes & new gland packing.
4. Repair / replacement of operating wheels.
5. Final checking of the operation of valves.

Item No – 13
Changing of HP & LP Valves (As per need)

HP Valves		LP Valves	
Size	**Nos.**	**Size**	**Nos.**
Φ 10 mm	15	Φ 10 mm	15
Φ 20 mm	20	Φ 20 mm	20
Φ 65 mm	05	Φ 40 mm	05

HP Valves		LP Valves	
Size	**Nos.**	**Size**	**Nos.**
Φ 100 mm (class – 2500)	02		
Φ 100 mm (class – 1500)	02		
Φ 175 mm (class – 1500)	01		
Φ 225 mm (class – 2500)	01		

Note: Nos. of valves may increase or decrease as per need.

Job involves:

1. Cutting of valve and shifting it to boiler spare store.
2. Shifting of new valve from store to site.
3. Fitting of valve and joint welding.
4. Stress reliving is to be done for valve class – 2500.
5. Radiography of all valve joints.

Note: Payment will be done on the basis of actual no.

Item No – 14

OVERHAULING OF (A) R. C. FEEDERS, (B) C. D. FEEDERS, (C) BUNKRES

(A) R. C. FEEDERS & (B) C. D. FEEDERS

1. Decoupling of motor, gearbox and motor removal.
2. Removal of front and rear cover.
3. Removal of scrapper chain.
4. Repair of feeder body, dismantling of front and rear sprocket assembly with guide mechanism.
5. Replacement of guide plates of bottom and top.
6. Changing of old base plates and shifting to scrap yard.
7. Changing of old measuring plate and shifting to scrap yard.
8. Cutting of new base plate, edge preparation and shifting to site to 8M.
9. Cutting of new measuring plate edge preparation and shifting to site at 8M.
10. Installation of new base plate in position and welding.
11. Installation of new measuring plate in position and welding.
12. Replacement / patch welding of coal inlet chute of raw coal feeder above (10M).
13. Repair of manhole of feeder.
14. Rectification of feed control mechanism.
15. Revisioning of old sprocket mech. / changing of bearings.
16. Installation of front and rear sprocket assembly in position.
17. Fixing of big sprocket assembly with driving shaft.
18. Revisioning of gear box and changing of gearbox internals.
19. Revisioning of tension mechanism of driving sprocket.
20. Shifting of scrapper chain from TPP store to site.
21. Fixing of new scrapper chain in position.
22. Alignment of gearbox with driving sprocket and fixing of driving roller chain. Alignment of motor with gearbox.
23. Painting of feeder body.
24. Trail run of feeder, adjustment of scrapper chain tension, fixing of chain guard and coupling guard.
25. Revisioning / repair of raw coal bunker gate.
26. Decoupling and removal of c. d. feeder.
27. Dismantling of feeder, revisioning of feeder, charging of bush and bearing.

28. Revisioning of feeder gate / changing of gate bush if required.
29. Revisioning of gearbox, charging of worm wheel, worm shift along with bearing.
30. Fitting of gearbox in position with feeder and coupling of c. d. feeders.
31. Changing of dust pipe line, patching and attending leakage of dust pipe lines of the feeder.

(C) Bunkers

1. Preparation of scaffolding for raw coal bunkers, coal dust bunkers from 13M and above all around the bunkers.
2. Cutting of 16mm thick MS plates of proper size and transporting them to raw coal bunkers and coal dust bunkers area at 13 M level.
3. Lifting, fitting, **and WELDING** of MS plates of required size around the damaged portion of raw coal bunker & coal dust bunkers.
4. Patch repair of damaged portion of top cover of raw coal bunker and coal dust bunker.
5. Changing of measuring rope, pulley counter weight for dust bunker. Repair of coal dust line from dust screw conveyor to coal dust bunker.

Item No – 15

Thermal insulation and aluminium sheeting work of boiler during its Capital repair

1. Shifting of bamboos for scaffolding at site
2. Transporting of insulation materials i, e slag wool, cement, asbestos powder etc. from store to site.
3. Transporting of Al / GI sheets from store to site.
4. Breaking & removal of old insulation as per directive of site in-charge. as different position of the boiler duct, h. p. pipe line & l. p pipe line etc.
5. Complete insulation of the portions where repair has been done as per the directive of the site in-charge.
6. Complete insulation of the damaged portions of duct, pipelines, hoppers etc. as per the directive of the site in-charge.
7. Removal of thermal insulation of all the headers at the drum floor.
8. Removal of thermal insulation of all the piping outside the boiler.
9. Fixing of thermal insulation of all the header at the drum floor.
10. Fixing of thermal insulation at all the piping outside the boiler.
    Total area of the insulation per unit of boiler – 4000 M2 (Approx).

Item No – 16

Tig Welding Joints For Repairing/Replacement of Boiler Tubes & Super Heater Drain Lines

Sl. No	Area	No. of Joints	Remarks
1.	Economizer Ø32 x 4	250	
2.	Screen S. H. Tubes Ø32 x 4	200	
3.	Convective – I Ø38 x 4	100	
4.	Convective – II Ø42 x 4.5	100	
5.	SS Pipe – 16 mm & 10 mm	100	
6.	Feed Line (Steel-20) Ø133 x 10	50	
7.	Feed Line (Steel-20) Ø175 x 16	30	
8.	a) Feed Line Ø76 x 7.6 b) Economizer Drain c) Soot Blower Line d) D. M. Water Line	50	
9.	H. P. Drain Line Ø38 x 4 & Ø32 x 3.5	100	

10.	Stub Joints	200	

Note:

1. Payment will be done on the basis of actual no. of joints.
2. Argon gas required for Tig welding is to be arranged by the party.
3. Job involves:
   a) Cutting of clamps.
   b) Cutting & removal of damaged tubes.
   c) Shifting of new tubes at site.
   d) Fitting & welding of joints.
   e) Proper clamping of high pressure tubes (SH tubes, Economizer tubes and water wall tubes).

Item No – 17
Radiography of Welding Joints

Sl. No	Area	No. of Joints to be Radiographed
1.	Economizer - Ø32 x 4	250
2.	Screen S. H. Tubes - Ø32 x 4	200
3.	Convective – I - Ø38 x 4	100
4.	Convective – II - Ø42 x 4.5	100
5.	SS Pipe – 16 mm & 10 mm	100
6.	Feed Line (Steel-20) - Ø133 x 10	50
7.	Feed Line (Steel-20) - Ø175 x 16	30
8.	a) Feed Line - Ø76 x 7.6	50
9.	Steam Line - Ø 225 x 18	02

Note: Payment will be done on the basis of actual No. of joints.

Item No. – 18
1. Rectification of all SH headers,panels,feed lines, steam lines, upriser, downcomer and feed line hanger support outside the terminal points of R&M job as applicable..

Item No. – 19
ID Fan:
1. Blanking of outlet ducts.
2. Removal of all inspection doors.
3. Opening of dome and side plates and locking of impellers.
4. Dismantling and removal of bearings.
5. Lifting of impeller along with shaft and shifting it to repair bay.
6. Impeller to be repaired / replaced.
7. Inspection of shaft and air-seal. To be repaired / replaced.
8. Inspection of foundation & anchoring bolts. To be repaired / replaced as per the inspection report.
9. Mounting of impeller (Old/New) on shaft.
10. Repairing of casing all around (from inside & outside).
11. Casings liners to be repaired / replaced.
12. Changing / repairing of cooling water coil and associated inlet & outlet lines along with the valves.
13. The entire suction damper flaps to be repaired. Dampers to be made operative.

14. Both the bearing housings and mechanical coupling are to be inspected. Defect to be rectified, if any. If needed, bearing housing to be replaced.
15. Positioning of impeller along with shaft in the hauling and locking of impeller.
16. Fitting of both side's bearings and their assembly.
17. Removal of outlet blanking plates.
18. Oil topping in the bearing housings. If any leakage persists, is to be attended.
19. After inspection, unlocking the impeller and fixing of all the inspection doors in position.
20. Fixing of coupling on shaft.
21. Changing of explosion vents & repair of vent's duct in flue gas line duct from ID Fan suction side common duct to discharge side chimney duct.
22. Preparation of scaffolding around ID Fans (after blanking point and up to chimney duct).
23. Cutting of 3.5 mm thick M.S Plates as per required size and shifting them from store to ID Fan area.
24. Fixing and welding of these M.S Plates around the damaged portion of the flue gas duct from ID Fan suction side common duct to discharge side chimney duct.
25. Repair / replacement of compensator.
26. Removal of scaffolding and cleaning of work area.
27. Shifting of all scraps to scrap yard.
28. Static / dynamic balancing of Impeller.
29. Alignment of HT motor.
30. Coupling of ID Fan with HT motor.
31. Trial run and liquidation of defects.

Inputs to be given by the vendors

1. The vendor has to arrange sufficient no. of general tools / tackles, welding machines, cutting sets, grinding machines, lighting arrangements with cable etc.
2. The vender has to arrange all sifting & lifting equipments like ,winch machine, Hydra, Crane etc along with truck, trailer etc.
3. The vender has to arrange sufficient quantity of consumables like general & special type welding electrodes, filler rods etc. approved by BPSCL, industrial gases, grinding wheels, cotton waste, markin cloth, hose pipes, kerosene oil / diesel, grease etc.
4. Sufficient no. of measuring instruments like ultrasonic thickness measuring instrument (minimum – 02 nos.), equipment & radio isotope for radiography testing, DPT kit & material for DPT, S/R equipment, ultrasonography machine, Vibrometer, vernier, screw gauge etc. required for pre and post-operating parameter study has to be arranged by the vendor.
5. The vendors has to provide all size of MS, HT and SS Nut and Bolts with washer as per requirements.
6. The vendor has to provide all size of metallic, non-metallic glands made by Champion, gaskets and asbestos rope as per requirements.
7. The vendor has to provide all type of scaffolding materials as per requirements.

Inputs to be given by the BPSCL

1. All spares like valve, damper, pipe, tube, plate, refractory materials, slag wool with cement, asbestos powder, mill system spares, etc., as per requirement.
2. Points of electrical supply at all required positions.
3. Water supply as per requirements.

ANNEXURE-IV: RECOMMENDED SPARES

Bidders to provide list of recommended spares along with price in the following proforma.

S. No.	Description	Qty/Unit	Unit Price	Total Price (Rs) properly packed for supply to purchaser's stores at site

ANNEXURE-V: PRELIMINARY SCHEDULE FOR ONE BOILER

Preliminary Schedule for BPSCL R&M job (One boiler - 220 TPH)																		
	Month																	
Job Description	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Order placement and kick off meeting with successful bidder																		
Design & review engineering																		
Detail Engineering by package contractor / EPC contractor																		
Review engineering by Steag																		
Manufacturing & delivery at site																		
Site Mobilization, Dismantling, R&M Installation Works & Commissioning at Site for 1st Boiler																		

ANNEXURE-VI: SUB VENDORS' LIST OF THE CONTRACTOR FOR MECHANICAL EQUIPMENTS

SUB VENDOR LISTS OF THE CONTRACTOR FOR MECHANICAL EQUIPMENTS

Sr. No.	Equipment / System	Name of Vendors
1.	LP VALVES & SPECIALITIES	L&T AUDCO, Chennai FOURESS ENGG LTD, Bangalore BDK ENGG INDUSTRIES LTD, Hubli KBL PUNE CRESCENT VALVES LTD, Mumbai LEADER VALVES LTD, Jalandhar H.SARKAR & CO, Kolkata INTERVALVE
2.	CONTROL VALVES	DRESSER, MASONAILAN , XOMOS, FISHER,KSB-MIL, COSO, HORA, CCI
3.	WATER STEAM CYCLE PIPES	BOCCARD, TECHNIP, TECHTUBI, ESSENER, HOCHDRUCK, NORDON, MAHASHTRA, SEAMLESS, INDIAN SEAMLESS, TISCO, JINDAL SAW PIPES, RATANAMANI METALS & TUBES LTD., ALSTOM, BHEL, THERMAX,GB ENMASH,BOSTIN
4.	WATER STEAM CYCLE FITTINGS	BEND JOINTS, RELIANCE, DEE DEVELOPMENT, GMW,STEWARTS & LLOYADS
5.	HANGERS & SUPPORTS	LISEGA,PIPE SUPPORTS (FORMERLY MYRICKS) / SPRING SUPPORT
6.	WATER / WATER HEAT EXCHANGERS	GEA-ECHOFLEX , ALFA LAVAL, IDMC,L&T
7.	REFRACTORY	KFS/ PARSHURAM/ PACIFIC / ACC / SRU / TATA REFRACTORY
8.	HP & LP DOSING SKID	PSI/ FLUID CONTROLS/ KISHOR/ ENPRO
9.	INSULATION	LLOYDS/ MURUGAPPA / ORIENT / ROCKWOOL INDIA / PUNJ LLOYD
10.	CLADDING	BALCO / HINDALCO/ INDIAN ALUMINIUM / LLOYAD
11.	SAFETY VALVES	L&T/ BHEL / JNM/ CHEMTROL / TYCO SANMAR
12.	BLOWDOWN VALVE	BHEL/ SEMPELL/ LEVCON / KSB / L & T
13.	RELIEF VALVES	BHEL/ L&T/ JNM
14.	IBR VALVES	AUDCO/ BHEL/ KSB/ ROCKWELL, MIL,DRESSER , TYCO
15.	NON-IBR VALVES	L&T/ KSB/ FOURESS
16.	BUTTERFLY VALVES	SAUNDERS/ FOURESS/ BDK/ INTER VALVE
17.	LARGE BUTTERFLY VALVE	BDK , SUFA, AUDCO, FLOVEL, CRESCENT, FOURESS
18.	BALL VALVES	KSB/ AUDCO/ FISHER-XOMOX/ FUIDLINE
19.	CHEMICAL PUMPS	KISHOR/ VK PUMPS/ AK HUBLI

Sr. No.	Equipment / System	Name of Vendors
20.	EXPANSION JOINTS	CORI ENGINEERS/ TECHPRO/ TRF/ MACNELLY BHARAT/ BEVCON
21.	STRUCTURAL STEEL	JINDAL STEEL, TATA STEEL, VIZAG STEEL, SAIL

The above list indicates the suppliers generally considered for supply of the major equipment / system identified. However, contractor can offer alternate makes, purchaser has the right to add / delete name of any vendor from the list during kick off meeting.