TECHNO-COMMERCIAL OFFER

TO

Client Details	End User Details
IBI Chematur Engineering & Consultancy Ltd. S-86, IBI House, Marol, Andheri East, Near Wellington Business Park, Mumbai, MH-400059 M: 99190 91678 P: 022-2850 5152 Ext: 344 procurement242@ibichematur.com	**BEC Chemicals Pvt. Limited (BEC)** Saykha, Dahej, Gujarat State

For

SUPPLY OF RAKHOH MEMBRANE X 50 5 TPH SVLOP 10.54 Kg/cm2 SOLID FUEL FIRED STEAM BOILER WITH FLUIDISED BED COMBUSTORS & WITH REQUIRED ACCESSORIES.

DATED: 24 MAY 2022

SUBMITTED BY

Rakhoh Industries Pvt. Ltd.

S-11, T Block, M.I.D.C., Bhosari, PUNE – 411 026
9673957432/9168617939
mohit@rakhoh.com,deshak@rakhoh.com
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Thermotech Systems Ltd.

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To,

IBI Chematur Engineering & Consultancy Ltd
S-86, IBI House, Marol, Andheri East,
Near Wellington Business Park
Mumbai

Kind Attention : Mr. Asif Naseer- Manager, Procurement
Mr. Ganesh Shenoy (Engineer- Project
Mr. Pratap Shinde (Principal Engineer-Process)

Dear Sirs,

Subject: Offer for 5 TPH 10.54 kg/sq.cm, Solid Fuel Fired External Furnace Water Wall Type FBC Boiler.

With reference to your mail enquiry, we thankfully acknowledge your requirement of Supply of **5 TPH 10.54 Kg/Sq. cm capacity Solid Fuel Fired FBC Combustor External Furnace Water Wall Type Boiler**. Here with we are attaching our most competitive offer for the same.

We have in the past handled similar projects for various Multinationals & Government Company's like Security Paper Mill Hoshangabad, IOCL Trombay, Hindustan Insecticides Ltd Rasayani, Hindustan Organics Ltd, Ordnance Factory Dehu Road, Bank Note Paper Mill (A project of Reserve Bank of India-Mysore), Venkateshwara Bio Distilleries Shirala, PIL Chemical Vapi, Gujarat Alkalis Ltd Vadodara, Kirloskar Pumps, Elliot Ebara Bangalore, PIL CHEMICAL, ALTA LAB, VA Tech Wabag etc. and under the various inspection agencies like Lloyds, BV, TUV, IBR, TCE, ABS, IRS etc.

In India, we are one of the regular suppliers of Boilers for Co – Generation Projects, Waste Management Projects, and Boilers for food processing, Dairy, Confectionary, Pharmaceuticals companies, Oil Mills, Rice Mills, Distilleries and Chemical Plants etc. We have also spread our wings in Countries like Africa, Bangladesh, Indonesia, Philippines, wherein we have our Branch Offices and have successful Installations in all this countries.

Whilst on the subject, we wish to reaffirm our confidence in supplying you the most reliable boiler and our assurance is based on confidence we have in building several boilers for the Indian & Overseas industries.

Thanking you and looking forwards to receive your valued order, we remain,
Yours faithfully,

For, RAKHOH INDUSTRIES PVT LTD **For, THERMOTECH SYSTEMS LTD.**

MOHIT PATIL **SHRIRANG SHAH**

INDEX

SOLID FUEL FIRED MEMBRANE TYPE INSTALLATION.

HIGH EFFICIENCY SOLID FUEL FIRED MEMBRANE TYPE EXTERNAL FURNACE FBC STEAM BOILER MODEL.

Annexure I

INTRODUCTION

RAKHOH INDUSTRIES PVT LTD is ISO 9001-2015 certified by TUV NORD India, ISO 14001:2015 & 45001:2018 certified by DNV-GL; specializing in the products such as:

- **POWER – X:** **Bi – Drum type High Pressure Boiler for Power Generation**
- **D Type:** **Bi – Drum Type High Pressure Oil / Gas Fired Boiler**
- **MEMBRANE – X:** **Smoke cum Water Tube Composite type Boilers**
- **COMBO – X:** **Combo X Solid Fuel Fired Steam Boiler**
- **OPTIPAC:** **Package Type Solid Fuel Fired Boilers**
- **HUSKON:** **Package Type Husk fired Boilers**
- **OILPAC:** **Oil Fired Package type Boilers**
- **THERMO – X:** **Thermic Fluid Heaters**
- **TFSG:** **Thermic Fluid Steam Generator**
- **Waste Heat Recovery Boilers / WHRU'S**
- **Heat Recovery Systems such as Air & Water Preheaters, Economizers.**
- **Pollution Control Equipment like Dust Collectors, trama, Bag Filters, Ventury Scrubbers.**
- **Steam Mountings & Fittings, Revamp, Retrofitting & Conversions**
- **Pressure Vessels, Tanks and all types of Heavy Fabrication work.**
- **Services & AMCs**
- **Other Engineering Consultancies**

CUSTOMER DATA (TO BE CONFIRMED)

SITE DATA:		
Location	**Gujarat**	
Altitude	< 500 Mtr. Above Mean Sea Level	
Ambient Temperature	Max. 45 Deg. C & Min 15 Deg. C	
Humidity	50 % Average	
Wind Speed	As per IS 875	
Seismic Coefficient	As per IS 1893	
FUEL DATA:		
Type	**Crushed Briquette**	**Indian Coal**
Fuel Size	<10	<10
Carbon	40.94 %	44.00 %
Hydrogen	4.58 %	3.10 %
Sulphur	0.04 %	0.32 %
Nitrogen	0.233 %	0.82 %
Oxygen	36.65 %	4.77 %
Moisture Max.	10 to 15 %	3 to 5 %
Ash	7.00 %	11.50 %
GCV of Fuel	3760 Kcal/kg	4200 Kcal/kg
NCV of Fuel	3450 Kcal/kg	4000 Kcal/kg
ELECTRICAL DATA:		
Voltage	415 V + 10%	
Frequency	50 Hz + 3%	
Combined	+ 10% with solid earth 3 Phase, 4 Wire system	
COMPRESSED AIR:		
Quality	Instrument Air	
Pressure	7 Bar with FRL	
WATER:		
Specification	As mentioned in our Water Specification Annexure	

❖ IMPORTANT NOTES & SOME SALIENT FEATURES OF PROPOSED BOILER:

- Boiler offered is 5 TPH; 10.54 Kg/cm^2 Steam Pressure; Dry Saturated Steam.
- Fuels – Primary: Indian Coal/Indonesian Coal.
  -- Secondary Fuel: – Crushed Briquette

  -- Steam Outlet Pressure SVLOP : 10.5 Kgs/Cm²
  -- Steam Pressure at Plant Entry : 9 Kgs/Cm²
- The FBC (Fluidized Bed Combustion) Boilers offered by us are made as per the latest IBR Regulations and are of Class-I Fusion welded construction. **Stringent quality control** is observed at every stage of manufacture right from raw material stage to testing of Boiler prior to dispatch. The pressure parts are manufactured from Boiler Quality Steel, fully welded construction, shell radiograph and hydraulically tested. One Steam cum Water drum which incorporates the Smoke Tube boiler bank. In bed tubes are provided within the combustion area to maintain a temperature range of 600ºC to 700 ºC. These tubes are connected with header at the bottom along with down comers and in bed tubes and risers to form a natural water circulation circuit. Water wall is provided at the sides of the furnace to form a water wall seal. Headers are provided at the bottom along with down comers to form a natural water circulation circuit. A convective evaporator section consisting of a Smoke tube boiler section is so designed as an inline arrangement.
- **Boiler Shell** is engineered to have Most Minimum Water Carryover and to have enough Steam/Water Storage Capacity. Also Steam / Water Interface is maintained to higher value so that Water Carryover is negligible. Moreover we provide Steam/Water Separator at Steam Outlet connection of Boiler. All these ensure Dry Steam and give added advantage for the Process where Steam Dryness is of utmost important like High Steam Pressure Process.
- Offered Boiler shall have **Separate Down comers and Risers for Membrane Walls and for In Bed Coils** Assembly. This ensures Enough Quantity of Water Circulation through Membrane Walls as well In Bed Coils.
- **Air Preheater** is of Modular Type with **Two Passes on Flue Gas Side**; complete Waste Heat Recovery shall be there.
- All Valves shall be Cast Iron Valve.
- **Fluidised Bed Combustor:** Proven Design – Bubbling Bed FBC is being offered which is most suitable Higher Ash Coal and Higher Fines & Moisture Imported Coals. Some Other agro – Waste Fuels like Crushed Agro Waste Briquettes can be burn in same FBC.
- Coal fed and spread by "**Over bed Feed System**". Our FBC is Perfectly Engineered for Imported Coals {From Indonesia; Australia; South Africa etc. Which varies in characteristics like Higher Fines {Powder & -3 mm pieces} Percentage; Higher Moisture Percentage etc. For Imported Coal; a separate Fuel Feed & Spread System named **"Under bed Fuel feed".** There are additional Equipment's like under bed Feed System; mixing nozzle SS Spreading nozzle PA Fan, Fuel Piping etc. Provided.
- FBC Air Nozzles shall be of SS 410 are well proven over the Years for much longer life.
- For Over bed feeding; Fuel Spreaders are made up from SS. Spreaders ensure uniform spreading of Fuel Particles uniformlyacross FBC Area.
- For Underbed feeding; Spreading Nozzles Assembly shall be of SS.
- Change Over from One Fuel to Other or One type to other type does not need stoppage of Boiler and can be done in normal Operation.

- **Furnace Design:** Furnace Design is **perfect for Higher Fines & Higher Moisture** Fuels like Indian Coal Indonesian Coal. There is perfect combination of Membrane-Water Wall Area and Refractory Walls Area. By providing all sides Total Water Membrane Walls; one can reduce Boiler Cost. But this results in lower Furnace Temperature. High Moisture Fuels need certain higher Furnace Temperature so that as soon as they enter the furnace; volatiles liberation start and ignition takes place. If Furnace Temperature is less then late ignition occurs, un-burnt particles leave furnace and we can see heavy black smoke. By keeping right proportion of Water & Refractory wall, advantages of both types are ensured.
- Furnace is designed to achieve 3 T's – must for perfect combustion.3 T's are- **Temperature; Turbulence & Time.** Temperature means Furnace Temperature. Higher Furnace Temperature is being maintained by providing enough Refractory Surface Area in Furnace. Turbulence means through mixture of Combustible Particles with Combustion Air. This is attained by High Pr. Fuel Spreading Air; Secondary Air etc. Time denotes Fuels' Particles residence time in Furnace. Enough Furnace Volume is provided so that Fuel Particles get enough time in Furnace to burn completely. Even if Fuel is with higher moisture; it gets enough time to burn completely. This also ensures; even if there is more moisture (water) in fuel, e.g. in monsoon; fuel gets completely burn before leaving the furnace. Result is Peak {Maximum} Combustion Efficiency.

Annexure III

❖ TECHNICAL SPECIFICATIONS:

-- Type of Boiler	-- Smoke cum Water Tube, External Fluidised Bed Furnace; Enclosed Membrane Water Walls & Refractory Walls connected to Shell with suitable Risers& Down Comers and with In Bed coils Assembly.
-- Design Code	-- IBR 1950 with its latest Amendments
-- Steam Output	-- 5000 Kgs/Hr 'F&A100 Degs C'.
-- Steam Pressure	-- 10.54 Kgs/cm² Safety Valve Lift Off Pressure
-- Hydro test Pressure	-- 15.81 Kgs/cm²
-- Flue Gas Passes	-- 3 Nos. {Including One in APH}
-- Flue Gas – End Temperature	-- 130 – 140Degs C.
-- Steam Dryness Fraction	-- 0.985 %
-- Fuel	-- Coal- Indian, Crushed Briquette, Indonesian Coal
-- Fuel Calorific Value	-- Coal – Indian: 4200 KCals/ Kg. -- Coal – Indonesian: 5500 KCals/ Kg. -- Crushed Briquette: 3760 KCals/ Kg.
-- Fuel Firing Mode	--Indian Coal –Over Bed Feeding & Spreading. -- Crushed Briquette: --Over bed Feeding --Indonesian Coal –Under Bed Feeding & Spreading.
-- Combustor	--Fluidized Bed Combustor
-- Furnace Draught	-- Balanced Draught by I D Fan; F D Fan
-- F B C {Grate} Area	-- 2.5 Sq. Mtrs
-- Furnace Volume	-- 20 Cu Mtrs
-- Efficiency on GCV Basis	-- Coal Indian: 4200 KCals/ Kg. -- 86 ±2 %. -- Coal Indonesian: 5500 KCals/ Kg. -- 86 ±2 %. -- Crushed Briquette: 3760 KCals/ Kg. -- 84 ±2 %.
-- Steam Generation Quantity-on various Fuels	-- Coal -- Indian: 100 % -- Coal -- Indonesian: 100 % -- Crushed Briquette: : 100 %
--Boiler Performance Test Standard	-- BS 845 By Heat Losses Method.
--Steam-Steam/Water Separator	-- Provided Inbuilt Make: Rakhoh
-- Waste Heat Recovery	-- Air Pre-Heater
-- Pollution Control Equipment	-- Multi Cyclone Dust Collector
-- Apprx. Boiler Dimensions	-- Length:9500 mm X Width : 6000 X Height : 10000 mm

Annexure IV

❖ MAKES OF BROUGHT OUTS:

Following is Our general list of Vendors. All Items mentioned below; are not applicable for this Offer.

-- Steel	-- TATA / SAIL /JSW/ Equivalent
-- Tubes	-- Jindal / TATA/ GST / Equivalent
-- Structural steel	-- SAIL / GST /JSW/ Equivalent
-- Feed Water Pumps	-- CRI/CNP
-- Fans	-- Rakhoh
-- Deareator Tank	-- Rakhoh
-- Couplings	-- Fenner / Motutoya/ Rathi
-- Bearings	-- SKF / FAG/ Equivalent
--Reflex level Gauge(waterlevel)	-- Pune Techtrol/ Equivalent
-- Valves	-- Utam/Atam/ Equivalent
-- Safety Valves	-- Darling Muesco/ Equivalent
-- Blow Down Valve	-- Levcon/ Equivalent
-- Fuel Feeders / Spreaders	-- Rakhoh
-- Castings	-- Rakhoh Approved Vendors
-- Air Dampers	-- Rakhoh
-- Metalic Bellows	-- Rakhoh
-- Gear Box	-- Greaves/ Equivalent
-- Geared Motor	-- Greaves / Equivalent
-- Soot Blowers	-- SISTON / Equivalent
-- Control Valve	-- Precision Control/ Equivalent
-- Refractory	-- R V Refractory / Equivalent
-- Mineral Wool	-- Rockwell / Minwool / Equivalent
-- Aluminum Cladding	-- Balco / Hindalco/ Equivalent
-- Electric Motors	-- ABB / Siemens / Equivalent
-- MCC / Control Panel	-- Rakhoh
-- VFD	-- ABB /Danfoss/ Equivalent
-- Power / Control Cables	-- Incab / Polycab/ Equivalent
-- Switchgear Components	-- L & T /Siemens/Schneider/ Equivalent
-- Temperature Gauges	-- H Guru / Pioneers/ Equivalent
-- Steam Pressure Gauge	-- H Guru / Pioneers/ Equivalent
-- Air Pressure Gauge	-- H Guru / Pioneers/ Equivalent
-- Thermocouples	-- Nutech/ Equivalent
-- Pressure Switches	-- Indfoss/ Equivalent
-- Level Switches	-- Levecon/ Equivalent
-- Temperature Scanner	-- Lectronek/ Equivalent
-- Compensating Cables	-- Thermopads/ Equivalent
-- Instruments Cables	-- Thermopads/ Equivalent

-- Above is general List of all Our supplieras. All Items not applicable for this offer.

Annexure V

❖ BOILER'S OPERATION PARAMETERS:

--Temperature Profile:--Flue Gas :

Detail	Temperature
-- Furnace – Fluidised Bed.	820 – 840
-- Free Board Zone	950–1000
-- Furnace Exit	725
-- Bank Exit {Shell & Tubes}	320
-- Air Pre Heater Exit	150

-- Combustion Air:

Detail	Value in Degs C
-- Inlet of Air Pre Heater	30
-- Outlet of Air Pre Heater	140 – 135

-- Flue Gas Velocity Profile:

-- Fluidised Bed	1.8 -- 2.4 Mtrs./Sec.
-- Furnace	1.3 -- 1.5 Mtrs/Sec
-- Shell & Tubes II Pass	10.0 -- 11.0 Mtrs/Sec
-- Air Pre Heater	10.0 – 12.0 Mtrs/ Sec
-- Flue Gas Ducting	10.0 – 12.0 Mtrs/ Sec
-- Chimney	9.0 – 10.0 Mtrs/Sec

--PRESSURE PROFILE:

--Steam/Water Pressure Profile:

Detail	Value in Kgs/Cm²
-- Water Pump Outlet	16
-- Safety Valves : Set Pressure - I	10.54
- II	10

-- Draught Loss / Pressure Loss: Flue Gas

Detail	Value in mm WG
-- Furnace	5
-- Shell & Tubes	30
-- Air Pre Heater	25
-- Dust Collector	70
--Bag Filter	140
-- Ducting	15
-- Total	310

-- Draught Loss / Pressure Loss: Combustion &Fluidization Air

Detail	Value in mm WG
-- Air Pre Heater	30
-- Ducting	30
-- F B C : Plenum & Nozzles	450
-- Pneumatic Spreader	220
-- Underbed –Mixing Nozzle & Fuel Spreading Nozzle	600

Annexure VI

❖ IMPORTANT DETAILS OF BOILER:

-- Heat Transfer Areas in Various Zones of Boiler:

Can vary; if required; when doing detailed Engineering.

-- Shell &Tubes Convection Zone	-- 90 Sq. Mtrs
-- Membranes -Water Walls	-- 39 Sq. Mtrs
-- In Bed Coils Assembly	-- 10 Sq. Mtrs
-- Air Pre-Heater	-- 48 Sq. Mtrs

-- Electrical Load:

Description	Connected HP/ KW	Consumed HP / KW
-- Boiler Feed Water Pumps {1 Working; 1 Standby}	5 / 3.89	3/ 2.33
-- Induced Draft {ID} Fan	30 / 22.18	18 / 13.30
-- Fluidising Air Fan -- 1 No.	25/17.94	15 / 10.76
-- P A Fan -- 1 No.	7.5/ 5.5	4.5/ 3.3
-- Rotary Air Lock Valves – 2 Nos.	2/ 1.5	1.2 / 1
-- Crusher	10/7.5	6/4.5
-- Fuel Feeders (1Overbed+ 1No. Underbed)	5 / 3.72	3/ 2.33
-- Total	84.5/62.23	50.7/37.52

Annexure VII

❖ ENGINEERING & TECHNICAL DETAILS:

All Data Is Tentative And Subject To Change; If Required; While Doing Detailed Engineering.

1. SHELL & TUBES CONVECTION ZONE:

S.N	Description	Details
1.	-- Shell Design Code	-- IBR 1950 with latest Amendments.
2.	-- Shell Material	-- ASTM SA 515 Gr.60 /70
3.	-- Shell Thickness	-- 10 mm
4.	-- Shell Diameter	-- 1700 mm
5.	-- Shell Length	-- 3500 mm
6.	-- Tube Plate Material	-- ASTM SA 515 Gr.60 /70
7.	-- Front &Rear Tube Plate Thickness	-- 16mm
8.	-- Tube Size & Thickness	-- 63.5 mm ODX 3.40 mm Thk.
9.	-- Tube Material	-- BS 3059 / 320 Part I ERW

2. MEMBRANE- WATER WALLS:

S.N	Description	Details
1.	-- Bottom Headers	
2.	-- Diameter Inner	-- 200 NB
3.	-- Material	-- SA 106 Gr B
4.	-- Top Headers	
5.	--Diameter Inner	-- 200 NB
6.	--Material	-- SA 106 Gr B
7.	--Riser	
8.	- Diameter	-- 200 NB
9.	--Material	-- SA 106 Gr B
10.	-- Membrane Tubes Size	-- 50.8 mm OD X 3.25 mm Thk.
11.	--Material	-- BS-3059 / 320 Part I ERW
12.	-- Membrane Strip	-- 40 mm Wide X 5 mm Thk
13.	-- Strip Material	-- M S Plate IS-2062

3. IN BED HEAT EXCHANGER DETAILS:

S.N	Description	Details
1.	-- Downcomer Quantity	-- 2 Nos.
2.	-- Details	-- 200 NB X 9.27 mm Thk.
3.	-- Material	-- SA 106 Gr B
4.	-- Riser Quantity	-- 2 No's.
5.	-- Details	-- 200 NB X 10.31 mm Thk.
6.	-- Material	-- SA 106 Gr B
7.	-- Bottom Header Quantity	-- 1 No.
8.	-- Details	-- 200 NB
9.	-- Material	-- SA 106 Gr B
10.	-- Top Header Quantity	-- 1 No.
11.	-- Details	-- 200 NB
12.	-- Material	-- SA 106 Gr B
13.	-- In Bed Tubes Diameter O D	-- 50.8 mm
14.	-- Thickness	-- 4.06 mm
15.	-- Material	-- BS 3059 / 320 Part I

HEADERS FOR MEMBRANE WATER WALLS & IN BED EXCHANGER ASSEMBLY:

S.N	Details	Quantity Nos.	Size
1.	-- Side - Bottom Headers	2	200 NB
2.	-- Top Header – Membrane	1	200 NB
3.	-- In Bed Heat Exchanger – Lower Header	1	200 NB
4.	-- In Bed Heat Exchanger – Upper Header	1	200 NB

5. AIR PRE-HEATER:

A Tubular Flue Gas Air Heater shall be provided downstream of the boiler to recover further Waste Heat from the Flue Gases and Heat the Combustion Air. Air Pre-Heater shall be complete with Tubes, enclosed in casing of 5/6 mm thickness. The Air Pre-Heater and Bag filter shall be designed so as to get final flue gas temperature 150°C. Air Pre-Heater tube material shall be ERW carbon steel, and confirming to BS 3059 Part II ERW or equivalent and tube thickness shall be 2.03 mm. Air Pre-Heater shall be so designed and located so that tubes can be removed/replaced without disturbing other equipment.

-- Type	-- Tubular. Flue Gases in Tubes. Air on Shell Side
-- Tubes	-- Plain Tues.
-- Flow	-- Counter Current.
-- Arrangement	-- Modular.
-- Tube Size	-- 63.5 mm OD X 2.20 mm Thk.
-- Tube Material	-- IS:1239 Medium
-- Nos. of Flue Gas Passes	-- 2 Nos.
-- Nos. of Combustion Air Passes	-- 1 No.
-- Bottom Ash Collection Hopper	-- Provided.
-- RAV for Ash Collection Hopper	-- Provided.
-- Bottom Support Structure	-- Provided

5. BOILER FEED WATER PUMPS:

S.N	Description		Details
1.	-- Type	--	--Centrifugal; Multistage; Self Priming
2.	-- Water Temperature	Deg's. C.	--105
3.	-- Quantity {1 Working, 1 Standby}	Nos.	--2 {1 Working, 1 Standby}
4.	-- Capacity	M^3/Hr	--6.25
5.	-- Head	Meters.	--126
6.	-- Speed	Rpm	--2900
7.	-- Motor Rating *	KW	--3.89
8.	-- Working Temperature	Deg's C	--105

6. DRAUGHT SYSTEM:

As standard Global Engineering Practice Fan Margins are maintained; while selecting the Fans. Margin on Capacity = 35 %. Margin on Head = 25 %.

INDUCED DRAUGHT FAN {I D FAN}:

S.N	Description		Details
1.	-- Type	--	-- Centrifugal; Self Cleaning
2.	-- Quantity	Nos.	-- 1
3.	-- Capacity	Mtrs.^{3} /Min.	-- 200
4.	-- Head	mm WG	-- 450
5.	-- Drive	--	-- 'V' Belt & Pulleys
6.	-- Fan Start	--	-- Cold Start
7.	-- Fan Speed	rpm	-- 960
8.	-- Motor Rating / Speed	KW / rpm	-- 22.18/ 1000
9.	-- V F D	--	-- Provided

FLUIDIZING AIR FAN {F D FAN}:

S.N	Description	Units	Value
1	-- Type	--	-- Centrifugal; Backward Curve
2	-- Quantity	Nos.	-- 1
3	-- Capacity	Mtrs.^{3} /Min.	-- 104
4	-- Head	mm WG	-- 725
5	-- Drive	--	-- 'V'Belt& Pulleys
6	-- Fan Start	--	-- Cold Start
7	-- Operating Temperature	Degs. C	-- 30
8	-- Motor Rating / Speed	KW / rpm	-- 17.94 / 2900

* Motor Rating is tentative

PNEUMATIC AIR FAN {P A FAN}:

For Underbed Fuel Feed" and for Secondary cum Spreading Air.

S.N	Description	Units	Value
1	-- Type	--	-- Centrifugal; Backward Curve
2	-- Quantity	Nos.	-- 1
3	-- Capacity	Mtrs.^{3} /Min.	--21
4	-- Head	mm WG	-- 725
5	-- Drive	--	-- 'V'Belt& Pulleys
6	-- Fan Start	--	-- Cold Start
7	-- Operating Temperature	Degs. C	-- 30
8	-- Motor Rating / Speed	KW / rpm	-- 5 / 2900

* Motor Rating is Tentative**.**

7. ROTARY AIR LOCK VALVE DETAILS:

Description	
-- Type	-- Airtight Rotating Flaps; Continuous Ash Discharge
-- Quantity	--3 Nos.
-- Location	--1 on Dust Collector Bottom Ash Hopper --1 on APH Bottom Ash Hopper --1 on Bag Filter Bottom Ash Hopper
-- Size	--250 mm { 10 " }
-- Drive	-- Sprocket & Chain Coupling with Geared Motor
-- Motor Rating / Speed	-- 1 HP / 1000 rpm : 40 rpm

8. MULTI CYCLONE DUST COLLECTOR:

S.N	Description	Details
1.	-- Type	--Multiple Cyclone
2.	-- Number of Cyclone Tubes	--20 No's
3.	-- Cyclone Tube Thickness	--4.85 mm
4.	-- Cyclone Tube Size	--200 mm
5.	-- Cyclone Tube Wall Thickness	--6mm
6.	-- Working Temperature	--300 Degs C upto
7.	-- Collection Efficiency	--97 %.
8.	-- Shell Thickness	--6 mm with Stiffeners.
9.	-- Pressure Drop on Flue Gas Side	--75 mm at 100 % MCR
10.	-- Bottom Ash Collection Hopper	--Provided
11.	-- Rotary Air Lock Valve	--Provided
12.	-- Nos. of Bottom Ash Hopper	--1 No.
13.	-- Nos. of Rotary Air Lock Valve	--1 No.
14.	-- Support Structure of Dust Collector	--Provided

9. FEED WATER PIPING: PRESSURIZED.

- Feed Water Piping from Feed Water Pumps to Water Flow Control Valve.
- From Water Flow Control Valve to Boiler's Shell.

10. BOILER FURNACE SUPPORTING STRUCTURES:

Boiler's Furnace Structures & Structure for Membrane Walls shall be provided; made from Heavy Duty M S Sections. Supporting Structure for Our Supply Air Pre Heater & Dust Collector shall be supplied by us. Other Structures –for Accessories & Peripherals – Platforms required for Maintenance; Tubes Cleaning; Easy Approach Standing Platforms for Safeties ; Controls ; Instruments ; Equipments; Accessories – are from Customer.

11. FLUIDISED BED COMBUSTOR:

S.N	-- Arrangement	
1	-- Separation	-- By Refractory Wall
2	-- Type	--Shallow Bubbling Bed, Atmospheric Pressure Fluidised Bed { AFBC}
3	-- F B C Grate	-- 1 No.
4	-- Fuel Feed Mode	-- For Crushed Briquette Than 10 % Moisture -- Overbed Feeding -- 1 No. Rotary Drum Feeders with V F D at Elevation. --Pneumatic Spreader mounted on Furnace. -- For Indonesian Coal –Underbed Feeding: - 1 No. Fuel feeder -- Fuel: Air Mixing Nozzles with Fuel Spreader Nozzles – 2 Nos. are provided.
5	-- Bubbling Bed Depth	-- 300 mm.
7	-- Expanded {Fully} Bed Height	-- 540 mm.
8	-- Bed Medium Material	-- Sieved Sand
9	-- FBC Turn Down Range	-- 60 to 100 % of MCR for Each Bed
10	-- FBC- Bed Particles Velocity on Turndown Range	-- 1.6 to 2.5 Mtrs/Sec
11	-- Bed Temperature	-- 750 -- 850 Degs C on Turndown Range.
12	--Fluidising Air Nozzles - Material	-- S S 410.
13	--Fluidising Air Nozzles' Arrangement	-- In Line with 100 mm Pitch in Both Directions
14	-- Refractory Walls' Thickness	-- 350 mm
15	-- Bricks Facing FBC	-- High Alumina { 40 % } Fire Bricks up to 1.5 Mtrs. Height
16	--Heavy Bed Material Drain Arrangement	-- Provided.

12. ROTARY DRUM FEDDER FEEDING SYSTEM FOR CRUSHED BRIQUETTE: OVERBED:

ROTARY DRUM FEEDERS & PNEUMATIC SPREADERS:

Feeders; which shall be located under Fuel Bunker shall pass on Fuel from Fuel Bunkers to Furnace. Pneumatic Spreader is mounted on FBC Furnace. Fuel Feeders shall be with VFD; means its speed can be controlled. Thus controlled and required Fuel Quantity shall be fed to the Furnace. This ensures the Best Quality Combustion as momentary rate of Feed is consistent and matches with rate of Combustion Air Quantity which is being supplied by Air Fans. In short consistency in Ratio of Air to Fuel is being maintained.

Pneumatic Spreader mounted on Furnace Wall – throws the Fuel Particles on Bed/ in Free Board Zone; uniformly.

-- FUEL FEEDER:

-- Type of Feeder	-- Fuel Feeder with Both Side Bearings
-- Location	-- Below Fuel Bunker
-- Numbers	-- 4 Nos.2 Nos. Per Furnace.
-- Motor Rating -- Screw Feeder	-- 2 HP
-- Length	-- 2 Mtrs. Approx.
-- Speed Control System	-- Variable Speed Controller {VFD}
-- Dirive	-- Direct Coupled with Love Joy Coupling.
-- Diameter of Screw	-- 300 mm.
-- Size if Trough	-- 320 mm Inside Dia.

PNEUMATIC FEEDER CUM SPREADER:

-- Type of Spreader	--Pneumatic Spreader
-- Location	-- Below Fuel Discharge of Fuel Feed Screw
-- Numbers	-- 2 Nos. 1 No. Per Furnace.
-- Trajectory Adjustment	-- By Adjusting Air Pressure.
-- Material of Construction	-- SS 304.

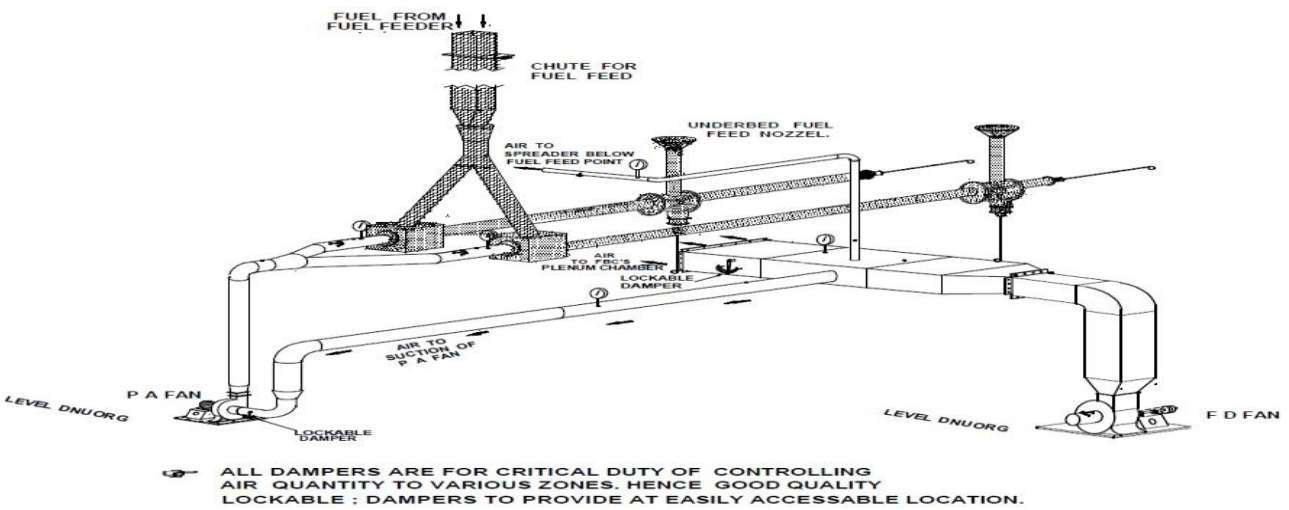
13. FUEL FEED SYSTEM FOR INDONESIAN COAL– UNDER BED:

Coal Screw Feeder &Pneumatic Spreaders: 1 No:

Screw Feeders; which shall be located under Fuel Bunker shall pass on Fuel from Fuel Bunkers to Furnace. Pneumatic Spreader is mounted on FBC Furnace. Screw Feeders shall be with VFD; means its speed can be controlled. Thus controlled and required Fuel Quantity shall be fed to the Furnace. This ensures the Best Quality Combustion as momentary rate of Feed is consistent and matches with rate of Combustion Air Quantity which is being supplied by Air Fans. In short consistency in Ratio of Air to Fuel is being maintained.

Pneumatic Spreader mounted on Furnace Wall – throws the Fuel Particles on Bed/ in Free Board Zone; uniformly.

ARRANGEMENT FOR 5 TPH FBC BED WITH UNDERBED FEEDING.



UNDER BED FEED SYSTEM: FOLLOWING ITEMS SHALL BE THERE: SEPARATE STREAMS FOR EACH COMBUSTOR.

FUEL SCREW FEEDER:

-- Type of Feeder	-- Screw Feeder with Both Side Bearings
-- Location	-- Below Coal Bunker
-- Numbers	-- 1 No.
-- Motor Rating -- Screw Feeder	-- 3 HP
-- Length	-- 2 Mtrs. Approx.
-- Speed Control System	-- Variable Speed Controller {VFD}
-- Drive	-- Direct Coupled with Love Joy Coupling.

PNEUMATIC FEEDER CUM SPREADER:

-- Type of Spreader	--Pneumatic Spreader
-- Location	-- Below Coal Discharge of Coal Feed Screw
-- Numbers	-- 1 No.
-- Trajectory Adjustment	-- By Adjusting Air Pressure
-- Material of Construction	-- S S

***Notes:* Motor Rating is tentative.

- Piping from P A Fan to Fuel: Air Mixing Nozzle. – 1 Nos.
- Fuel & Air Mixing Nozzle. – 4 Nos.
- Fuel Carrying Pipe from Mixing Nozzle to Spreading Nozzle mounted in FBC-Bed – 2 Sets
- Spreading Nozzle mounted in FBC – Bed. 2 in Each Bed. Made from SS Alloy.

14. VALVES & FITTINGS:

S.N	Description	Size mm	Nos.
1	-- Main Steam Valve	100	1
2	-- Stop Valve in F W Line – After Pumps	40	2
3	-- Non Return Valve – F W Line	40	3
4	-- Safety Valve	50	2
5	-- Auxiliary Valve – Shell.	40	1
6	-- Valves for Mobery Isolation & Other Instruments	15	4
7	-- Gate Valve for L. Transmitter; Pr. Transmitters	20/15	6
8	-- Blow down– Shell	40	1
9	-- Bottom Headers	15	2
10	-- Gate Valve for Gauge Glass X 2 Pairs	20	1
11	-- Mobery	15	2
12	-- Air Vent Valves Shell	15	1
13	-- Air Vent Valves On Water Walls Top Points	20	2
14	-- Level Gauges: C/ C Distance: 300 mm; with Drain Cocks.	20	2
15	-- Mobery Assembly { for Low Water Level Alarm}	15	1
16	-- Isolation & Drain Valves for Mobery	15	3

15. ELECTRICAL MCC; CONTROL PANEL & INSTRUMENTATION

ELECTRICAL CONTROL PANEL:

Self Standing – Dustproof- prewired for all Controls & Safeties shall be there. There shall be separate Panels for Power Circuit and Control Circuit. Power Circuit – MCC – is pre wired; connecting all Motor's Switchgears in a logical Sequence as per Control Logic. Contains individual Motors' Fuses; Contractors; Overload Relays.

Control Panel shall be with Standard Features like Voltmeter; Ammeters.

The following supervisory and control instruments complete with free standing instrument panel, necessary piping and leads between the panel and the points of measurement shall be provided.

16. FBC INSTRUMENTATION:

INSTRUMENTS FOR FBC: -

• One No. TIC: Bed Temperature Indicator Cum Controller; Digital; Panel Mounted; with Two Set Points.

• One No. TI: Bed Temperature Indicator; Digital; Panel Mounted.

• Two Nos. Temperature Sensors {Thermocouple}; Al-Cr Junction; 25 mm Dia; 1000 mm Long; with SS Sheath

• 25 Mtrs. Compensating Cable Al-Cr.

• Air Pressure gauge for FBC air plenum chamber, Dial 8", Range 0 to 1000 mm WG -3 No's.

• Multi-Point Temperature Indicator with Selector Switch- Panel Mounted :-(1+1 = 2 No's)

• For Air & Flue Gas Circuit: Two Nos.; 6 Points; Temperature Indicators; Multipoint with Selector Switch; Digital Panel Mounted.

• Air Pressure Gauges: Local Mounted; 6" Dial.

For Combustion Air Circuit: --At FD Fan Outlet & For FBC Chamber.

For Water & Steam Circuit: Two Nos.; 6 Points; Temperature Indicators; Multipoint with Selector Switch; Digital Panel Mounted.

• Temperature Sensors {RTD}: for Water & Steam

At F W Pump Outlet

At Outgoing Steam Line from Boiler Shell

• Temperature Indication Sensors {RTD} for Flue Gas:

At Boiler's Outlet

At Air Pre Heater Outlet

At I D Fan.

17. V FDs:

Shall be located in Control Panel

-- 1 Nos. for I D Fan Motor

-- 2 Nos. for Fuel Feeders Motors

Annexure VIII

SUMMERY: BOILER WITH STANDARD SCOPE OF SUPPLY:

Engineering & Technical Specifications as mentioned above:

1.	-- Boiler Shell & Tubes Assembly.
2.	-- Membrane Water Walls with Roof Membrane with Down comers & Risers.
3.	-- In Bed Tubes Assembly with Headers. With Down comers& Risers.
4.	-- Air Preheater Assembly.
5.	-- Feed Water Pumps Assembly. 2 Nos. One Working; one Standby.
6.	-- Draught System. 1 No. ID Fan; 1 Nos. F D Fans; 1 Nos. P A Fans.
7.	-- Rotary Air Lock Valve Assembly. 3 Nos.
8.	-- Multi Cyclone Dust Collector.
9.	-- Feed Water Piping: Pressurized.
10.	-- Boiler Furnace Supporting Structures
11.	-- Fluidised Bed Combustors – Twin.
12.	-- Fuel Feed System for Crushed Briquette– Over Bed.
13.	-- Fuel Feed System for Indonesian Coal – Underbed.
14.	-- Valves & Mountings.
15.	-- Electrical MCC; Control Panel & Instrumentation.
16.	-- FBC Instrumentation.
17.	-- V F Ds for Fans; Fuel Feeders.

Annexure IX

OPTIONAL SCOPE OF SUPPLY FOR BALANCE OF PLANT

	Equipment name	Pulse Jet Boiler Bag Filter for Boiler	
	BOILER		**5 TPH**
SN	Parameters	Unit	
A	**GENERAL**		
1	Make		**RAKHOH**
2	Model	PJ	
3	Equipment name		Bag Filter
	Application		Boiler Flue Gases
4	Type of bag filter	Type	Pulse Jet
5	Air Handling Capacity	**m3/Hr**	**15000**
6	Type of Fuel used		Briquette /Indonesian Coal/Indian Coal
7	Dust concentration at suction	g/nm3	< 30
8	Dust concentration at exhaust	mg/Nm3	<115
9	Inlet Gas Temperature	Deg C	180-200
10	Maximum Design Temperature	Deg C	250
11	Pressure Drop Across Bag Filter	Mm WG	150
12	Air to Cloth Ratio	Mtr /min	1.15
13	Velocity at inlet and outlet of the bag filter	m/s	16
14	Velocity inside bag filter	m/s	0.5
B	**CONSTRUCTIONAL DETAILS**		
1	Hopper Valley angle	Deg	61
C	**HOUSING**		
1	Material		MS
2	Thickness	mm	3
D	**HOPPER**		
1	Material	mm	MS
2	Thickness	mm	5
E	**TUBE SHEET**		
1	Material	mm	MS
2	Thickness	mm	5
F	**INLET MANIFOLD**		
1	Material	mm	MS
2	Thickness	mm	5
G	**FILTER BAG DETAILS**		
1	Diameter	mm	155
2	Length	mm	3050
4	Total Filtration Area	m2	256
5	Fabric Material		100% Woven Fibre Glass

6	Fabric Weight	GSM	750/800
7	No of filter bags	Nos	144
8	Temperature	Deg C	250
9	Cage	Type	H R Alu. Painted
10	Ventury	Type	MS Spun
H	**PULSE JET CLEANING SYSTEM**		
1	Compressed Air Requirement	m3/Hr	101 Appx
2	Compressed Air Pressure Requirement	kg/cm2	6-7
I	**SOLENOID VALVE DETAILS**		
1	Qty of valves	Nos	11
2	Type		Solenoid Actuated diaphragm
3	Make		U-Flow / Maniks
4	Casing	Type	MS
5	No of housing	No	1
6	No of hoppers	No	1
J	**Instrumentation**		
1	Manometer		100 – 0 -100
2	Compressed air pr. Gauge	Fibig	Provided
3	Solenoid Actuated diaphragm Valve	Size (inch)	1 1
4	Differential Pressure switch	Indfoss	Provided
6	Isolation valves on Air Header		Provided
L	Painting		HR Silver
TECHNICAL SPECIFICATIONS FOR ROTARY AIR LOCK VALVE			
1	Size	NB	250
2	Quantity	Nos	1

N.B: Technical data specified above are broad & may change suitably during detail engineering.

Utilities Required:

•	Compressed Air	Pressure: 5 – 7 kg/cm^2 (G; Grade:-Oil and moisture free.

2. TECHNICAL SPECIFICATIONS FOR WET SRCUBBER

Design Basis for the Supply

Sr. No.	Parameter	Unit of Measurement	Value	Data Scope
1	Application		Spray Tower Sulphur Dioxide/Dust Absorption System	RIPL
2	Flow rate	m3/hour	12000	RIPL
3	Inlet Temperature	°C	150	RIPL
4	Operating Pressure	atm (abs)	1	RIPL
5	Boiler Capacity	TPH	5	RIPL
6	Fuel Type		Coal/ Briquette	RIPL
7	Operating Hours	hours	24	RIPL
8	Fuel Sulphur Content	%	0.1	RIPL
9	Maximum Sulphur Dioxide Loading	kg/hour	15	RIPL
10	Maximum Sulphur Dioxide Inlet Concentration	ppm	600*	RIPL
11	Maximum Design Efficiency	%	85	RIPL
12	Absorption Solution		5% Caustic	RIPL
13	Superficial Velocity	m/s	1.82	RIPL
14	Maximum Pressure Drop	mm WC	100	RIPL

***Note: The design of the entire system is based on the above parameters. Kindly confirm the parameters. Any change in the parameters can alter the performance of the system.**

TECHNICAL SPECIFICATIONS OF THE SUPPLY

Sr. No.	Particulars	Unit of Measurement	Description
General Specifications			
1	System		Spray Tower - Absorption System
2	Pollutant Gas		Sulphur Dioxide
3	Design Flowrate	m3/hour	12000
4	Design Pressure Drop	mm WC	150
5	Operating Temperature	oC	60-150
6	Operating Pressure	atm (abs)	1
Spray Tower Absorber			
1	Quantity	nos.	1
2	Configuration		Single column
3	MOC		S.S. 304
4	Diameter	mm	1800
5	Height	mm	3400 approx.
6	Spray Zone Height	mm	As per the requirement
7	Ground Clearance	mm	As per the requirement
8	Thickness	mm	4
9	Stiffeners		MS IS 2062 - As per the scope
10	Surface Finish		Not applicable
Pumps, Lines and Auxiliaries			
1	Pump Flowrate	m3/hour	40
2	Pump Head	m	35
3	Pump Power	HP	15
4	Pump MOC/Make		S.S. 316/Globe-Star
5	Pump Quantity	nos.	1
6	Pump RPM	RPM	2900
7	Pump Seal Type		Mechanical
8	Spray Line Size	mm NB	As per the requirement
9	Spray Line MOC		MS IS 2062
10	Spray Line Quantity	nos.	As per the scope
11	Drain Line Size	mm NB	As per the requirement
12	Drain Line MOC		MS IS 2062
13	Drain Line Quantity	nos.	As per the scope
14	Fixtures, Fittings and Valves		As per the scope
Internals			
1	Spray Nozzles Quantity	Nos.	As per the requirement

2	Spray Nozzles MOC		S.S. 316
3	Spray Nozzles Type		Full Cone
Other Essentials			
1	Monkey ladder, Manhole, Supports and Platform		MS IS 2062 As per the requirement
2	General Accessories		Hardwares and auxiliaries

Annexure X

SCOPE FOR BALANCE OF PLANT.

PART B - SCOPE OF SUPPLY FOR BALANCE OF PLANT		
Sr. No.	**Item Description**	**Quantity**
1.	**A. SUPPLY OF FUEL FEEDING SYSTEM :** • Bucket Elevator with motor - 1 No. • Bunker Capacity with Capacity of 8 hrs holding back up. • Briquette Crusher with motor - 1 No. • Rotary Drum/Screw feeder with motor - 1 No. • Control Panel with necessary cable - 1 No. **B. OVERBED FUEL FEEDING FOR AGROWASTE BRIQUETTES/COAL** Combination of two Equipment's. • One is Fuel Feeder and other is Pneumatic Spreader	1 Set
2.	**Self-Supported Chimney 30 Mtrs Height Top Dia. 700 mm** • As Per Standard Design IS 6533 Material Grade IS 2062 with Mfg test Certificates • Type of Chimney Self-Supported • Top Diameter of Chimney 700 mm • Bottom Piece Conical 10 Mtr. X 10 mm thk, • Middle Piece 10 Mtr. X 8 mm thick & • Top Piece 10 Mtr. X 6 mm thick • With Duel Base Plate Arrangement & Ash Door Arrangement • Aviation Lamp, Sampling Port, Top Side Canopy Provided • Platform; Ladder & Cage 2 Nos provided • Earthling Strip Provided • Junction Box For Aviation Lamp Provided • Templates and bolts Provided • Painting duly painted with High Temp Al Paint.	1 Set
3.	**FLUE GAS & HOT AIR INTERCONNECTING DUCTING FOR THE UNIT** • Connecting Flue gas duct between boiler smoke chamber and APH inlet. • Connecting interconnecting ducting between APH, Dust Collector, and ID Fan upto chimney outlet. • Manual air & flue gas damper at FD fan & ID Fan inlet. • Metallic expansion bellow at inlet and outlet of ID fan. • Connecting cold air duct between FD fan and APH • Connecting Hot air duct between APH and Furnace. • Connecting secondary air duct from tapping after FD fan to furnace. • Interconnected ducting shall be sent in loose form. • Flue Gas Duct will be fabricate from 5 mm Thickness MS Plates • Hot Air Ducting will be fabricate from 3 mm Thickness MS Plates	1 Set

4.	**MS FEED WATER SERVICE TANK – 10 KL CAPACITY** • Tank Plate As per IS 2062 GR.A. • Tank will be fabricate from 6 mm Thickness MS Plates. • Magnetic level indicator for feed water tank & it will have digital display of level • with high-low level alarms. • Water Inlet & outlet Valves, Vent, Over flow, Man Hole • Gauge Glass tube connection for Level Indication • Supply with Heat Resistant Paint. & Insulation for Tank. • RCC Structure, Platform, Ladder & Railing arrangement at site In client Scope	1 Set
5.	**BOILER HOUSE PIPING (BLOW DOWN; DRAIN & VENT PIPING):** • All Blow down & Drain Lines from respective Points to Blow down Pit, which shall be about 6 Mt. away from Boiler House. • Feed water piping from Feed Condensate tank to Feed Pump Suction including Isolation Valve & Strainers. (Approx. 20mtr) • Air Vents are left 1 Mtr. above roof. • All Blow down Piping shall be IBR Quality wherever required; MS ERW Piping. • All Blow down & Drain Piping shall be rigidly supported.	1 Set
6.	**SUPPLY OF BOILER HOUSE ELECTRIC CABLING WITH TRAYS** • Controls & Instruments Cabling: • Fitting of Cable Tray & Cable laying from Rakhoh Control Panel to various Motors & Instruments located at Sites; supplied by us. As per Standard boiler house layout. • Cables and Wires inside Boiler House shall run on Cable Trays. • Supports for Trays shall be taken from Boiler House Walls / Structure. • Customer shall give Earthing Point near Boiler House Wall.	1 Set
7.	**OPERATION & MAINTENANCE PLATFORMS** • Supply of Boiler Shell Front Tube cleaning Platform, Railing & Ladder Arrangement as Per Rakhoh Standard Layout. • Shell Top valves approach operating platform with ladder Ladder Arrangement. • Mobrey & Instrument Header Operating platform • Bucket Elevator maintenance platform with Ladder • All Platforms shall be with required Ladders; Railing and Foot Guards all around. • Platforms shall be provided with M S Structural Supports; Angle Cross; Gussets etc. to make it Self-Standing. • **Water Tank RCC structure, Platform, Railing & Ladder Arrangement is in client scope.**	1 Set
8.	**POWER CUM PLC BASED CONTROL PANEL ASSEMBLY** • The panel consists of a sophisticated but user friendly circuit enabling the operator to run the boiler in automatic or manual mode as desired. Various instruments and safety features are as detailed below: In auto mode the boiler will operate all sequences automatically. The Panel is lockable by a key to prevent unauthorized operation of the boiler. The MCC will be fixed (non-draw out) type modular with single front and is suitable for indoor application. • Panel shall be confirming to IP 54 degree of protection. It shall be made out of 14 /16 SGW CRCA sheets. Internal & external surfaces shall be epoxy based powder coated. Prior to powder coating all surfaces shall be de-greased & de-rusted with 7 tank treatment. Panel will be floor mounted with cable entry from bottom.	1 Set

	• Control & power section shall be physically isolated. • **Power section –**Shall consist of incomer, starter feeder & VFD for all field mounted motor driven equipment. MCB/MCCB is provided for incomer & feeders as per current rating. • **Control section –** Shall be PLC based with controller & colour, touch-screen 11" HMI. Following controls are provided – 1. Combustion control. 2. Boiler level control with feed pump ON-OFF control. 3. Boiler pressure, flue gas temperature indication. 4. Alarms & interlocks as mentioned in PID. 5. Start / stop operation of all feeders.	
9.	**INSULATION & CLADDING MATERIAL FOR HOT EQUIPMENT** • Insulation LRB, Density – 100 – 120 kg/m^3, Thickness - To suit application. • Cladding MoC – Aluminium, Thickness 24 SWG • For Connecting Hot air duct between APH and Furnace • For Connecting Flue gas duct from Boiler to APH, including APH	1 Set
10.	**REFRACTORY:** • The Refractory lining; 350 mm; Furnace below Water Walls will be built with two layers of Fire Bricks of 230 mm Thick; backed up by layer of insulation bricks of 115 mm thick. • Around Stoker; up to 1.5 Mt. Heights; Fire Facing Layer shall be of High Alumina {40 % Al2O3} shall be there. These Quality bricks have much higher erosion resistance; hence give far longer life compared to normal IS-8 Bricks. So Refractory does not need any maintenance for longer time. • Fire Brick; IS – 8; High Alumina {40%}: 230 X 115 X 75 up to 500 mm above Stoker Top. Fire Brick; IS – 8: 230 X 115 X 75 Fire Brick; IS – 6: 230 X 115 X 75 Fire Brick; IS – 8: 230 X 152 X 75 Tile for Locking Insulation Bricks: 230 X 115 X 75 Arch Bricks – Side: 230 X 115 X (75 – 63) Arch Bricks – End: 230 X 75 X (115 -87) Firecrete Castable: Thermoset / Accoset Fire Clay Asbestos Sheet; 6 mm Thk. As filler for Expansion Gaps Tying & Locking 230 X 230 X 75 Tile for inter locking the Layers.	1 Set
11.	**SITE ERECTION WORK of Boiler & accessories like** • Assembly & erection of Boiler Shell & MPA on foundation. • Installation & Erection Boiler complete with mounting & fittings supplied with boilers. • Installation & Erection ID fan, FD Fan, APH, and MDC on foundation. • Installation & Erection Boiler feed Pumps. • Assembly & erection of Ducting from boiler to chimney. • Assembly & installation of Chimney on Foundation. • Installation & Erection Boiler feed water tank 10 KL capacity.	1 Set

	• Non-IBR Feed water piping (Approx. 20mtr) from condensate tank to Feed Pump including Isolation Valve & Strainers. • Installation & Erection of Non IBR Boiler House Piping for Safety Valve, Outlet Vent, Air vent Line, Mobrey, Drain line, GGD rain., • Installation & Erection of complete Auto fuel feeding including Crusher, Bucket elevator, Storage bunker, hopper &fuel feeder. • Installation & Erection of Electrical Panel • Fitting of Cable tray & Cable Laying from control panel to ID & FD Fan, Mobrey switch, rotary airlock motors, Feed Pump, Screw feeder, crusher & Elevator Motor etc. • Preparing & doing Hydraulic test of Boiler & Blow down Valve. • Registration of Boiler only in IBR office, Submission of folder, Ground inspection, Boiler for 6 month PO, Approval for Provisional Firing, Liasioning with IBR • Crane Require for unloading of all material erection of boiler & accessories including Chimney is in Client Scope.	
	PART C - SCOPE OF SUPPLY FOR STEAM DISTRIBUTION SYSTEM	
12.	Supply of Steam Piping from Boiler House to PRS (Approx. Length 24 Mtrs) with all required bends, flanges, valves, Expansion Loops & Insulation with Al Cladding	1 Set
13.	Supply of Pressure Reducing Station.	1 Set
14.	Erection work of Steam Distribution System.	1 Set
15.	Supply of Steam Flow Meter.	1 Set
16.	Supply of Water Flow Meter.	1 Set

Annexure XI

BATTERY LIMITS FOR BOILER

Sr. No.	Description	Battery limit
1.	Water	From Suction Flange of Feed Water Pump
2.	Steam	Up to outlet flange of main Steam stop valve Up to outlet flange of air vent valve Up to outlet flange of safety valve
3.	Blow down	Outlet of Blow down Valves of shell.
4.	Drain	Up to outlet of header drain valve in water wall Up to AWLC drain Up to outlet of all drain valves
5.	Ash	Up to outlet of ash chute at shell outlet Up to outlet of RAV on APH Up to outlet of RAV on MDC Up to outlet of RAV on Bag Filter
6.	Flue Gas	Outlet of Boiler, In & Out of APH and Dust Collector, Suction and Delivery of I.D. Fan, Inlet /outlet FD Fan Inlet/Outlet PA Fan
7.	Electricals	Incoming & outgoing main cable connection terminal points in control panel. Input & output terminal on individual load (Motor) points.
8.	Fuel	Inlet of Fuel Feeders.

BATTERY LIMITS: FOR BAG FILTER.

9.	Compressed air	At the inlet of solenoid valve for pneumatic actuator and at the inlet of compressed air header for bag filter.
10.	Electric cable	At the input of the control panel and at the output of the control panel.

WATER QUALITY REQUIREMENT:

Extract from IS 10392 – 1982, Specification for feed water and Boiler water for low and medium land Boilers.

Characteristics		Requirement
Feed water		
Total hardness (as $CaCO_3$) Maximum	PPM	Less than 5 PPM
pH value at 25 ^{O}C		8.5 to 9.5
Dissolved Oxygen Maximum	PPM	0.01
Total Iron Maximum	PPM	0.01
Total Copper Maximum	PPM	0.01
Silica (as SiO_2) Maximum	PPM	0.05
Conductivity at 25 ^{O}C	µs/cm	2.0
Hydrazine Residual	PPM	0.02 – 0.04
Boiler Water		
Total hardness (of filtered Sample) (as $CaCO_3$)	PPM	Not detectable
PH Value at 25 ^{O}C		10.0 to 10.5
Residual Sodium Sulphate (as Na_2SO_3) Maximum	PPM	Non – Detectable
Residual hydrazine as (N_2H_4)	PPM	0.05 to 0.3
Phosphates (as PO_4), (if added)	PPM	25 to 30
Total dissolved solids Maximum	PPM	1200
Silica (as SiO_2). Maximum	PPM	3.0

Annexure XII

EXCLUSIONS:

1. ESP.
2. Civil work for Foundations of Pumps, Spray Tower and Recirculation Tank of 20000 Liters capacity & Continuous supply of caustic to maintain pH value of 9 (5% Caustic Solution) and 20000 liters fresh water daily and during commissioning of the system & Slurry Drain and Disposal System from Spray Tower Absorber to Plant
3. Fuel preparation, storage and conveying system.
4. Ash handling System.(Conveying and storage)
5. Feed water piping from Water Tank to Pumps and piping. Water treatment Plant & Testing Equipment.
6. Any Steam piping, Blow down Piping & Condensate Recovery system and its piping.
7. Boiler Drain and Blow-down piping beyond our battery limits.
8. PRS for Process and Deareator Tank is in Client Scope.
9. All Supporting MS/RCC Structure & Foundation Bolt
10. Electrical cabling incoming & outgoing terminals of our control panel. Also terminals of all Instruments and motors.
11. Underground Earthling, Earth termination & earth pit.
12. Control room along with the air conditioner, if any
13. Utilities (water, power, air, gas, etc.) and consumables required for assembling, Erecting and Commissioning the boiler
14. Fuel, water, instruments and accessories for commissioning, operation and for Performance testing of boiler
15. Fire protection system
16. Spares for installation, operation and maintenance of boiler
17. Assembling, Erecting and commissioning of the supplied material.
18. Clearance from statutory bodies, regulatory authorities like IBR, Air Pollution Board, Electricity Board, Factory Inspector etc.
19. Boiler house or any enclosure for Boiler, lighting & ventilation / air conditioning.
20. All civil design & civil work, cable trenches & blow down / drain pits
21. Crane required at site for Unloading and Commissioning activities
22. Any Third Party Inspection
23. All LC and Banking Charges.
24. Transportation & Transit Insurance.
25. Any Item not mentioned in our scope of supply.

Annexure XIII

PRICE SCHEDULE:

SN	Description	Qty	Price
1.	**Price of the Boiler:** 5 TPH Capacity ' f & a 100 Degs C ' Safety Valve Lift Off Pressure 10.54 Kgs/Cm² Fuel:- Indian Coal/Indonesian Coal & Crushed Briquette **"Annexure VIII"** 1. Boiler Shell & Tubes Assembly. 2. Membrane Water Walls with Roof Membrane with Down comers & Risers. 3. In Bed Tubes Assembly with Headers. With Down comers& Risers. 4. Air Preheater Assembly. 5. Feed Water Pumps Assembly.2 Nos. One Working; one Standby**.** 6. Draught System. 1 No. ID Fan; 1 Nos. F D Fans; 1 Nos. P A Fans. 7. Rotary Air Lock Valve Assembly. 3 Nos. 8. Multi cyclone Dust Collector. 9. Feed Water Piping. Pressurized. 10. Boiler Furnace Supporting Structure. 11. Fluidised Bed Combustors. 12. Valves& Mountings**.** 13. Electrical Control Panel 14. FBC Instrumentation.	1 Set	₹ 2,32,00,000.00
2.	-- Price for Supply as mentioned in Annexure IX " Supply of Auto Fuel Handling System (Coal/Briquette Crusher, Bucket Elevator, Storage Bunker, Fuel Feeder with VFD) for Over bed firing of Crushed Briquettes As mentioned Under **-- Sr. No. 01. Fuel Handling System**	1 Set	
	-- Price for Supply as mentioned in Annexure IX " **-- Sr. No. 02. Chimney**	1 Set	
3.	Price for Supply as mentioned in "Annexure IX" -- **Sr. No. 03. Flue Gas Duct Circuit for Boiler**.	1 Set	
4.	Price for Supply as mentioned in "Annexure IX" **-- Sr. No.04. Water Tank.**	1 Set	
5.	-- Price for Supply as mentioned in "Annexure IX" **-- Sr. No.05. Boiler House Piping/ Blow Down; Drain & Vent Piping with Instruments Piping:**	1 Set	
6.	-- Price for Supply as mentioned in "Annexure IX" **-- Sr. No.06. Electrical Cabling & Cable Trays.**	1 Set	
7.	-- Price for Supply as mentioned in "Annexure IX" **-- Sr. No.07. Operation& Maintenance Platforms.**	1 Set	
8.	-- Price for Supply as mentioned in "Annexure IX" **No. 08 . Supply of PLC Based Control Panel**	1 Set	

SN	Description	Qty	Price
9.	-- Price for Supply as mentioned in "Annexure IX" **-- Sr. No.09. Insulation & Cladding.**	1 Set	
10	-- Price for Supply as mentioned in "Annexure IX" **-- Sr. No.010. Refractory**	1 Set	
11.	**Supply & Erection of IBR Steam Piping from Boiler House to PRS** (Approx. Length 24 Mtrs) with all required bends, flanges, valves, Expansion Loops & Insulation with Al Cladding	1 Set	
12	**Supply of Pressure Reducing Station.** 10.54 Kg/cm2 to 7 Kg/cm2	1 Set	
13.	Supply of Steam Distribution Header with Two Inlet Connection & Three Connection of Outlet with all Valve mounting and Insulation material will be supplied loose	1 Set	
14.	-- **Price for Erection And Commissioning** of Rakhoh Supplied Equipment As mentioned Under – **- Sr. No.10. Erection and Commissioning**	1 Set	
	(Govt. Challan fees & Crane for material unloading, Erection work is in client Scope)	1 Set	
	Site IBR Formalities for 5000 Kg Boiler, Steam Piping, Blow Down Piping, PRS & Steam Distribution Header.	1 Set	
15.	Price for Supply of **Bag Filter.**	1 Set	
16.	Price for **ICBD Damper For Bag filter**	1 Set	
17.	Price for Supply of **Wet Scrubber.**	1 Set	
18.	Supply of **Steam Flow Meter with Totalizer.**	1 Set	
19.	Supply of **Water Flow Meter.**	1 Set	
20.	Supply of **Bottom Auto Blow System.**	1 Set	
21.	Supply of **LP Dosing System.**	1 Set	
22.	Supply of **Earthling (Only For Rakhoh Supplied Material)**	1 Set	
	TOTAL FOR ABOVE MENTIONED ITEMS		**₹ 2,32,00,000.00**
	AMOUNT IN WORDS: INR TWO CRORES THIRTY-TWO LACS ONLY		

Annexure XVI.

❖ COMMERCIAL TERMS & CONDITIONS:

Sr. No	Description	
1.	Price Basis	Ex Work Bhosari, Pune.
2.	GST.	18 % As per Government Rules.
3.	Payment Terms	30% Advance 20% Against Boiler Hydro at RIPL work shop 50% Against PI 8 Days before dispatch.(we shall give a PBG of 10 % for the period of 6 months.)
4.	Service Charges	Rs.5,000/- Per Day Purchaser to provide for free of charge economy Class To & Fro Bus, Train Tickets, VISA Charges, accommodation, local conveyance, work permit (if required), security within site premises and immediate medical facilities to our engineers visiting for supervision of E & C.
5.	Delivery	For Supply Material Boiler will ready for dispatch at our works within 120 days from the date of receipt of Technically & Commercially clear order with requisite advance. (considering current Pandemic scenario) For Erection &Commissioning 45 Days from the Date of Dispatch.
6.	Packaging & Forwarding	Extra @ 3%.
7.	Terms	As per enclosed Terms & Conditions of Supply.
8.	Transportation & Transit Insurance	Client Scope
9.	Validity	08 Days
10.	Warranty	12 months from the date of commissioning or 18 months from the date of dispatch, whichever is earlier

Thanks & Regards

For, RAKHOH INDUSTRIES PVT LTD.

MOHIT PATIL

For, THERMOTECH SYSTEMS LTD.

SHRIRANG SHAH

Annexure XV

❖ TERMS & CONDITIONS OF SALE.

1. **Prices:**

Unless otherwise stated in writing, all prices are ex-works, Pune / ex-our supplier's work in case part of the goods are manufactured at their works and are exclusive of packing, loading, forwarding, handling freight, transit insurance, etc. All taxes, excise and other duties and levies as applicable at the time of delivery shall be charged separately. Octroi, if any, shall be borne by the buyer. The buyer registered under the sales tax act is advised to send sales tax form if any, along with the purchase order. Otherwise, the State/central tax will be charged at full rate as applicable. Prices are subjected to verification depending on raw material cost.

2. **Delivery:**

Deliveries quoted are subject to prior sale and confirmation by us. Delivery period starts from the date of receipt of the necessary advance as per payment terms and only when all details of contract have been made clear and both parties are in agreement with the conditions of the contact. Its strict observance presumes the fulfillment of the contractual obligations of the buyer particularly the conditions of payment agreed upon. Delivery promises are based on the current manufacturing program. We will endeavor to keep the date given, but accept no liability for failure to do so. Delay in the delivery quoted shall not render the contract as void on the part of the buyer and no claim either direct or indirect can be made on delays. In no case shall the buyer have the rights to withhold balance payment or reject goods on account of delay in delivery. We shall have the option of delivering the goods contracted in part consignments and also earlier than quoted delivery period.

The delivery period for boiler is based on adequate visits being paid to our works by the local boiler inspectorate office for inspections as per IBR and adequate power being made available.

3. **Terms of Payment**:

As per mention above.

4. **Advances:**

Advances paid against an order shall not be subject to any interest. We shall have the right to adjust the demurrage against such advances because of delay in lifting the ordered equipment or because of any incidental expenses we may incur on the buyer's behalf. The advance shall be forfeited in the event of cancellation of order for whatever reasons.

5. **Validity:**

While every effort will be made to keep our quotation valid for acceptance for a period of ten days from the date hereof we may be constrained to modify this offer within this period due to circumstances beyond our control.

6. **Packing & Forwarding:**

Packing and forwarding will be charged extra at rates prevailing at the time of supply of the equipment. Packing for dispatch will be in accordance with our standard practices.

7. **Insurance**:

Transit insurance has to be covered by the buyer. We shall convey the dispatch particulars as soon as possible after actual dispatch to enable the buyer to arrange insurance.

8. **Inspection:**

The boiler is made under stage-by-stage inspection during fabrication by the inspector of Steam Boilers and Smoke Nuisances, Maharashtra. It conforms to the latest Indian boiler regulations. If necessary, and called for specifically in the order the goods will be offered for visual inspection only at our works/our supplier's works. M/e will intimate the date of inspection about 15 days in advance. In case inspection is not carried out on the date so advised, we shall be free to dispatch the consignment as per terms of delivery.

9. **Dispatch:**

The main boiler will be dispatched in unpacked condition. All the mountings, fittings and fragile components will be dismantled and sent suitably in packed condition. Since the boiler is of package construction, the work of assembly at site is nominal and can be done easily and economically by the buyer. We shall supply the necessary assembly drawings, loading diagram and other details to facilitate the assembly work. However, if required you may avail of services of our authorized sub-contractors for erection and commissioning assistance at extra cost.

10. Mode of Delivery:

All deliveries will be ex our works, Pimpri / ex our supplier's works. The goods may be dispatched in one or separate lots at our option. If we are required to dispatch the goods on behalf of the purchaser we can arrange to do so by road transport only to a destination named by the purchaser, on freight to pay basis on the understanding that no liability is attached to us. The freight charges contracted by us on behalf of the buyer will be treated under the buyer's authority and shall therefore be final.

11**. Order Confirmation:**

All orders placed on us directly or through our regional offices will be binding on us only after our head office in Pune has issued a formal order acknowledgement.

12. **Specifications etc**.:

Specifications, dimensions, designs, descriptions, shades of paints, etc. are not binding on us in minute details and are subject to reasonable alternations without notice.

13. **General Lien**:

We shall be entitled to general lien on goods in our possession or dispatched for all money due to us by the buyer, both under this contract or any other account and we shall also be entitled to apply any money in our hands under any contract due to us under any other contract or contracts.

14. **Warranty**:

Our liability in respect of goods supplied is limited to our standard guarantee and warranty. In the case of boilers and burners, proper performance is dependent upon, amongst other factors, proper installations of chimney, connections, proper oil, water and electrical connections; use of adequate treated water and in general following of instructions specified in our service manuals with proper care and maintenance of the equipment. However, we undertake to make goods by repair (and failing which, by replacement) defects arising out of faulty design, materials or workmanship within six months of the date of dispatch. If we so require, the parts in respect of which a claim is made must be sent at buyer's expense to our works before liability can be entertained under this clause. Such expenses will be refunded if our liability is admitted. Bought outs components are guaranteed by us only to the extent of guarantees given to us by: our suppliers. Electrical components such as heaters, motors, contractors, etc. ace however not covered under this warranty. This warranty is subject to:

I. Installation having been completed within three months of dispatch of the equipment

II. The supply / installation having been formally accepted as per the handing over clause.

III. Supply of right fuel as per relevant specification available at the equipment inlet in the proper graded form and size.

IV. The equipment or part thereof not being subject to accident alteration abuse or misuse

15. **Storage**: If the goods cannot be delivered, charge will be made for storage, insurance and interest at the rate of 1% of the Invoice value for each week or part thereof commencing 15 days from the date of Performa Invoice.

16. **Force Majeure**:

The offer is subject to "Force Majeure" by which it means causes beyond control such as war, Invasion, civil disobedience, government orders or restrictions, lockouts, riots, fire, earthquake, floods, accidents, breakdown of machinery, delay or inability to Obtain labor, raw materials wagons, shipping, space or any other causes whatsoever beyond our reasonable control affecting us or subcontractors, suppliers etc.

17. **Erection and Commissioning Assistance**:

After receipt of the boiler at site and if it is desired to have the services of our engineer we shall depute our engineer for the services at extra cost. To and from air and / or train fair, boarding and lodging and conveyance facilities at site will be extra at buyer's cost. These charges will be reckoned from the date of departure of our engineer from our works till the date of return to our works commissioning service offered at the rate mentioned in quotation and terms mentioned above include:

a) Reasonable number of visits/meetings to help prepare the user to safely unload the material when required.
b) Discussion of installation details in terms of physical/technical requirements.
c) Making the user conversant with Statutory requirements if any, and discussing details of requirements in respect of power supply, feed water, fuel system etc.
d) Ensuring that the installation has finally been made as recommended.
e) Commissioning the unit for a short run from the point of view of mechanical working and to set necessary.
f) Conducting demonstration for the purpose of user's education for equipment operation and maintenance.
g) The buyer against Performa Invoice Prior to delivery shall pay the above charges.

18. **Handing Over**:

Unless otherwise specified in the order and accepted handing over of the equipment and/or installation would be considered as completed and a formal completion certificate shall be issued by the buyer/user, if. The material has been supplied as per the terms and scope of supply with agreed deviations, if any.

a) Erection if involved has been completed generally as per terms of order with unavoidable Deviations.
b) The equipment has been commissioned, if applicable, generally as agreed.
c) The equipment and /or installation has been put to commercial use either with or without help of our engineer.

The buyer/ user is expected to put the equipment to commercial use only after issuing a formal completion certificate. Our responsibility in terms of warranty shall cease straightaway if the equipment is put to use without formal taking over.

19. **Boiler Registration**:

VSRUN boiler is made as per Indian Boiler Regulations / BS-2790 and hence a set of relevant documents and certificates signed by the Chief Inspector Of Boilers, Maharashtra or any other agreed approval agency is provided for each boiler. All preparations for hydraulic test, open inspection and other IBR formalities to be completed for registration by the boiler inspectors of the concerned state would be made by the buyer at his cost.

20. **Secrecy Of Documents / Information**

We undertake to provide such drawings, design calculations and fabrication details in support of the boiler supplied together with material as well as test and hydraulic certificates which are mandatory and required for the purpose of acceptance and registration of the boiler by the receiving party.

21. **Cancellation:**

All orders received and acknowledged by us shall not be subject to cancellation either wholly or partly far any reason whatsoever. in the event of cancellation of an order, the advance shall be forfeited.

22. **Jurisdiction**:

All contracts between the buyer and ourselves are deemed to be entered into at Pune and are therefore, subject to the jurisdiction of courts at Pune.

23. **General**

Any condition or other matters relating to this quotation not expressly stipulated will be a matter of mutual discussion and agreement at the time of accepting the order. If this quotation is accepted and an order is placed, all the above conditions of sale stand automatically accepted

In order to offer our clients the advantage of the latest technical development and progress, we reserve the right to amend details of design without notice.