

Boiler Make Thermodyne

S.NO	DESCRIPTION	UOM	SUPPLIER	
	<b>GENERAL</b>			
1	Type of Boiler	:	Atmospheric Fluidised Bed Combustion Boiler	
2	Type of circulation	:	Natural circulation	
3	Boiler design code	:	IBR 1950 with latest amendments	
4	Main fuel for MCR generation	:	100% Imp.Coal	
5	Secondary fuel for MCR generation	:	50% Imp.Coal and 50% Rice Husk	
6	Fuel Sizing	:	less than 6 mm	
7	Start up fuel	:	Charcoal with LDO (By GWT, if required)	
8	Boiler performance testing		As per ASME PTC 4.1 abridged version	
	Ultimate Analysis (% by wt)		Imported Coal	Rice husk
	Carbon	%	54.68	36.1
	Hydrogen	%	3.1	4.2
	Nitrogen	%	0.74	1.0
	Sulphur	%	0.7	0.2
	Moisture	%	25	9.8
	Ash	%	5	16.3
	Oxygen	%	10.78	32.4
	GCV	kcal/kg	5050	3,150
	<b>BOILER PREDICTED PERFORMANCE</b>			
1	Boiler Capacity (MCR)	kg/hr	:	18000
2	Peak Capacity of Boiler (for ½ hr Once in 8 hrs)	kg/hr	:	19800
3	Steam temperature at S.H. outlet	°C	:	440 ± 5
4	Superheated steam control range	%	:	60 - 100
5	Steam pressure at super heater outlet	kg/cm <sup>2</sup> (g)	:	45
6	Minimum continuous rating of the Boiler with automatic controls	kg/hr	:	10800
7	Excess air	%	:	25
8	Quantity of fuel fired at MCR	kg/hr	:	2910
9	Boiler efficiency based on G.C.V @ 100% Imp. Coal	50% %	:	84
	Imp. Coal + 50% Rice Husk	%	:	82
10	Aux. Power Consumption @ MCR Load	kWh	:	220
11	Net Heat Input	Mkcal/h	:	14.68
12	<b>Flue Gas Temperature</b>	°C		
a.	Furnace temperature		:	820 - 830
b.	Air preheater outlet		:	140 - 150
13	<b>Water Temperature</b>	°C		
a.	Economiser inlet :		:	105
b.	Economiser outlet :		:	185 - 195
14	<b>Steam Temperature</b>	°C		
a.	Secondary Super heater outlet :		:	440 ± 5
15	Air Temperature leaving Air heater	°C	:	125 - 135
16	<b>Desuperheater spray quantity load</b>	kg/h	:	400
17	<b>Provided Heat Transfer Areas</b>	m <sup>2</sup>	IBR	

S.NO	DESCRIPTION	UOM	SUPPLIER		
a.	Bed coil		:	63	
b.	Furnace		:	240	
c.	Primary Superheater		:	100	
d.	Secondary Superheater		:	85	
e.	Boiler Bank / Evaporator		:	160	
f.	Economiser		:	260	
g.	Air heater		:	275	
18	Overall Boiler circulation ratio		:	18	
19	<b>BOILER CONSTRUCTION DETAILS</b>				
<b>19.1</b>	<b>Drums</b>			<b>Steam Drum</b>	<b>Mud Drum</b>
a.	Internal diameter	mm	:	1150	814
b.	Drum shell material		:	SA 516 Gr. 70	SA 516 Gr. 70
c.	Drum operating pressure at MCR Kg/cm <sup>2</sup> (g) :		:	48.5	49
d.	Type of Steam Drier / Separator provided :		:	Demister pad	
e.	Type of drum internal :		:	Baffle and Screen	
<b>19.2</b>	<b>Bed Tube Assembly</b>				
a.	Type of tube arrangement		:	Inline	
b.	Tube size (OD x T)	mm x mm	:	50.8 X 6.35	
c.	Bed Tube material		:	SA 210 Gr. A1	
<b>19.3</b>	<b>Water wall Assembly</b>				
a.	Type of construction		:	Fin welded water wall	
b.	Tube size (OD x T)	mm x mm	:	63.5 X 3.66	
c.	Tube material		:	BS 3059 ERW	
<b>19.4</b>	<b>Super heater</b>			<b>Primary</b>	<b>Secondary</b>
a.	Type of flow		:	Counter	Parallel
b.	Arrangement		:	Inline	Inline
c.	Tube size (OD x T)	mmxmm	:	38.1 X 3.66	38.1 X 3.66
d.	Tube material		:	SA 210 Gr A1	SA 213 T11/T22
<b>19.5</b>	<b>Desuperheater</b>				
a.	Type		:	Fixed Spray Type	
b.	Location		:	Between primary and secondary superheaters	
c.	Number off		:	1	
d.	Material of pipe		:	SA 106 GR. B	
<b>19.6</b>	<b>Boiler Bank</b>				
a.	Type of Bank		:	Counter Flow	
b.	Tube Size (OD X T)		:	50.8 X 3.66	
c.	Tube Material		:	BS 3059 ERW	
<b>19.7</b>	<b>Economiser</b>				
a.	Type of Economiser		:	Bare Tube	
b.	Arrangement		:	Inline	
c.	Tube size (OD x T)	mm x mm	:	38.1 X 3.66	
d.	Tube material		:	BS 3059 ERW	

S.NO	DESCRIPTION	UOM	SUPPLIER		
e.	No. of block of economiser		:	4	
f.	Type of flow		:	Counter	
<b>19.8</b>	<b>Air heater</b>				
a.	Arrangement and type		:	Staggered and Recuperative	
b.	No of Block		:	2	
c.	Tube size (OD x T)	mm x mm	:	63.5 X 2.34	
d.	Tube material		:	BS 6323	
e.	No. of rows Corton Steel tube		:	4	
<b>19.9</b>	<b>Fluidised Bed</b>				
a.	Fluidised bed size	mm x mm	:	5.94 X 2.20	
b.	Bed area / Compartment	m <sup>2</sup>	:	4.35	
c.	No. of Compartments		:	3	
d.	Bed plate material		:	IS 2062	
e.	Bed plate size (L x W)	mm x mm	:	5.62 X 1.96	
f.	Fuel Nozzle material		:	SA 106	
g.	Fuel Nozzle cap material		:	SS 310	
h.	No. of fuel Nozzles / Compartment		:	4	
i.	Material of Air Nozzle		:	SS	
j.	Method of Nozzle attachment to Bed Plate		:	Welded	
p.	Recommended fuel particle size at the inlet of furnace	mm	:	6	
q.	No. of ash drain pipes / Compartment		:	2	
s.	Ash drain pipe material		:	SA 106 Gr. B	
<b>19.10</b>	<b>Fuel Feeding System</b>				
a.	Type of feeders		:	Rotary pocket feeders	
b.	Location		:	Below bunker hopper	
c.	Number of feeders		:	6 (125% Capacity)	
d.	No. of Branch feed lines from a single feeder		:	2	
e.	Bunker bottom opening size	mm x mm	:	370 X 370	
<b>19.11</b>	<b>Ducting Specification</b>			<b>Air Duct</b>	<b>Gas Duct</b>
a.	Material of construction		:	IS 2062	IS 2062
b.	Thickness	mm	:	4	4
<b>20</b>	<b>Deaerator</b>				
a.	Capacity of Deaerator (Max.)	m <sup>3</sup>	:	22	
b.	Design Pressure	kg/cm <sup>2</sup> (g)	:	2.5	
c.	Temperature of deaerated Water	°C	:	105	
d.	Temp. of Incoming Water	°C	:	40	
e.	Capacity of Storage Tank	m <sup>3</sup>	:	9	
f.	Quantity of steam required	kg/h	:	2000	
g.	Pressure of Steam at Inlet of Pr. Control Station	ata	:	2.5	
h.	Temp. of Steam	°C	:	150	
<b>21</b>	<b>Safety Valves</b>			<b>SV-I</b>	<b>SV-II</b> <b>SV-III</b>
a.	Location		:	Steam drum	Main steam line

S.NO	DESCRIPTION	UOM	SUPPLIER		
b.	Number provided		:	1	1
c.	Type		:	Spring loaded	
d.	Relieving capacity	Kg/h	:	7425	4950
e.	Set pressure	Kg/cm <sup>2</sup> (g)	:	53.5	50
f.	Hydraulic test pressure	Ata	:	80.5	75
g.	Seat leakage pressure		:	53.5	50
<b>22</b>	<b>Fans (ID fan head has been revised to 430 mmwc by considering Bag filter is in series with MDC)</b>			<b>FD</b>	<b>ID</b> <b>PA</b>
a.	Quantity		:	1x100%	1x100%
b.	Flow at MCR	m <sup>3</sup> /sec	:	6.24	1.11
c.	Actual head required	mmwc	:	800	700
d.	Gas temp	°C	:	40	130
e.	Medium		:	Ambient Air	Fluegas
f.	Speed	rpm	:	1500	3000
g.	Types of connection		:	Direct coupled	Direct coupled
<b>23</b>	<b>Boiler Feed Pumps</b>				
a.	Design Flow	m <sup>3</sup> /hr	:	22.1	
b.	Pressure Head	mlc	:	600	
c.	Feed Water Temp	°C	:		
d.	Qty		:	2 Nos. (2x100%) (1W +1S)	
<b>24</b>	<b>CHEMICAL DOSING SYSTEM</b>			<b>HP Dosing</b>	<b>LP Dosing</b>
a.	Type of system		:	Skid mounted	Skid mounted
b.	Tank Material		:	SS 410	SS 410
c.	Head developed by pump	Kg/cm <sup>2</sup> (g)	:	51	2.5
d.	Chemical to be dosed		:	Tri sodium phosphate	Sodium Sulphite
e.	Piping material from HP to Drum inlet		:	SS	SS
<b>25</b>	<b>FUEL STORAGE BUNKER</b>				
a.	No. of Bunker		:	One	
b.	Type		:	Twin Bunker	
c.	Material to be stored		:	Imported Coal & Rice Husk	
d.	Material of construction		:	IS 2062	
e.	Storage volume of the bunker	m <sup>3</sup>	:	100 m <sup>3</sup> (2 x 50 m <sup>3</sup> )	
<b>26</b>	<b>MDC</b>				
a.	Type :		:	Multi Cyclone	
b.	Number of MDC/Boiler :		:	One	
c.	Flue gas flow at 140°C m <sup>3</sup> /sec		:	9.5	
d.	Gas inlet temperature °C		:	150	
e.	Inlet dust concentration gm/Nm <sup>3</sup> (dry basis)		:	4.72	
f.	Outlet dust concentration mg/Nm <sup>3</sup> :		:	800	
g.	Pressure drop across MDC mmWC :		:	75 mmWC	
h.	MOC		:	IS 2062	

S.No	Description	TECHNICAL DETAILS
<b>1</b>	<b><u>STEAM TURBINE</u></b>	Make MAXWATT
	Type	Multistage, Impulse, Extraction condensing
	Casing split	Horizontal
	Rotor type	Solidly forged & machined rotor with integral disks.
	Shaft seal	Labyrinth
	Bearing support	Double pedestal
	Rated speed	8000 RPM
<b>2</b>	<b><u>Oil system:</u></b>	
	<b>Lube Oil</b>	
	Governing oil pressure	6 Kg/cm <sup>2</sup>
	Lube oil pressure	1.5 – 2.0 Kg/Cm <sup>2</sup>
	Oil type	servo prime ISO VG 46
	Oil reservoir capacity	1200 liters
	Oil quantity for initial fill	1000 liters
	Oil quantity for flushing	1200 liters
	Material of oil reservoir	Carbon steel
	Material of oil piping from Pumps to filters	Carbon steel
	Material of oil piping from Filters to bearings	SS
	Retention time	5 mins
	<b>Main oil pump:</b>	
	Type	Gear (positive displacement) Operating speed
	Operating Speed	1500 rpm
	Capacity	180 Liters/minute

Discharge pressure	6.0 Kg/cm <sup>2</sup> (g)
Driver	Gearbox low speed shaft
<b>Auxiliary oil pump:</b>	
Type	Gear (positive displacement) Operating speed
Operating Speed	1500 rpm
Capacity	180 Liters/minute
Discharge pressure	6.0 Kg/cm <sup>2</sup> (g)
Driver	AC motor, 5 HP, 415 V, 3 Phase
<b>Emergency oil pump:</b>	
Type	Gear (positive displacement) Operating speed
Operating Speed	1500 rpm
Capacity	50 Liters/minute
Discharge pressure	0.8 Kg/cm <sup>2</sup> (g)
Driver	DC motor, 1.0 HP, 110 V
<b>Oil cooler:</b>	
Type	Shell and tube
Oil inlet temperature	60°C
Oil outlet temperature	48 °C
CW inlet temp	32 °C
CW outlet temp	35 °C
CW supply pressure	2.5 Kg/cm <sup>2</sup> (g)
CW Quantity	40 m <sup>3</sup> /hr
Oil flow Capacity	155 Liters/minute
Mounting	Saddle support
Tube material	SS304 ERW

	<b>Lube oil filter:</b>	
	Element type	Micro-felt
	Oil flow Capacity	155 Liters/minute
	Oil filtration Capacity	10 - 15 MICRONS
	Mounting	Foot
	<b>Oil Vapour Extractor:</b>	
	Type	Centrifugal
	Driver	ac Motor (0.5 HP, 230 V, 1 Phase)
	Mounting	Flange
	<b>Bearings:</b>	
	Journal Bearings	
	Type	Cylindrical
	Material	White metal with steel Babbitt
	Thrust Bearings	
	Type	Tilting pad
	Material	White metal with steel Babbitt
<b>3</b>	<b>Governing System:</b>	
	Governor:	
	Type	Electronic Woodward 505E.
	Inputs (critical)	Speed
	Control range	20 % to 110% of rated speed
<b>4</b>	<b>Hydraulic Accumulator:</b>	
	Type	
	Working fluid	
	Capacity	
<b>5</b>	<b>Governing oil filter:</b>	

	Element type	Micro felt
	Oil flow Capacity	
	Oil filtration Capacity	
<b>6</b>	<b>Safety devices:</b>	
	Over speed trip	Hydraulic / Electrical
	Low lube oil pressure trip	Hydraulic
	Low control oil pressure alarm	Electrical
	High exhaust pressure trip	Through Pressure switch
	Hand trip	Push to trip
	Remote trip	Solenoid operated blocks & dump valve
	Operation	Energize to open & trip
<b>7</b>	<b><u>GEARBOX</u></b>	
	<b>Design</b>	
	Type (Double / Single)	Single Helical, Single Reduction
	Input / Output speed	8000 / 1500 RPM
	Ratio	5.33 : 1
	Service factor	1.3, AGMA
	Accessory	
	<b>Bearings</b>	
	Journal Bearings	
	Type	Cylindrical
	Material	White metal with steel Babbitt
	<b>Thrust Bearing</b>	
	Type	Cylindrical
	Material	White metal with steel Babbitt
	<b><u>COUPLINGS</u></b>	



	High Speed Coupling	
	Type	Flexible element
	Low Speed Coupling	
	Type	Flexible, Gear type
<b>8</b>	<b><u>ACCESSORIES</u></b>	
	<b>Gland vent condenser:</b>	
	Design code	HEI
	Type	Shell & Tube
	Driver for air blower	AC motor, 1.0 HP( 415 V)
	Tube material	
	Shell & end cover material	
	Tube sheet material	
	Accessory	
	Noise level	
<b>9</b>	<b><u>BARRING GEAR ARRANGEMENT:</u></b>	
	Type	Manual / Auto engagement & Auto disengagement
	Driver	AC motor, (10 HP, 415 V, 3 Phase)
	Gear Ratio	1 : 25
<b>10</b>	<b><u>GENERAL:</u></b>	
	<b>Material of construction for major turbine components</b>	
	HP Steam casings	Alloy steel
	LP Steam casings	Carbon steel
	Rotor shaft	Forged alloy steel
	Blades	X22 Crmo V121 / X20 Cr13
	Nozzle rings	AISI 410

	Gov. Valve trim	AISI 410
	Shrouds	AISI 410
	Labyrinth gland seals	SS 410 / Nickel bronze
	Diaphragms	Carbon steel
	Steam strainer	SS 304
<b>11</b>	<b>Material of construction for major gearbox components</b>	
	Casings	MS
	Pinion & Integral shaft	EN 36
	Gear wheel	EN 36
	Gear wheel shaft	EN 8
	Noise level	110 db (A) @ 1.0 M
	<b>Dimensions of turbine</b>	
	(Including gearbox) in mm	3500 (L) * 2500*2800 (H)
	<b>Weights</b>	
	Weight of turbine	12000, KG
	(Including Gearbox)	
<b>12</b>	<b><u>CONDENSING SYSTEM</u></b>	
	<b><u>STEAM SURFACE CONDENSER</u></b>	
	Type	Shell and tube
	Capacity	8 Tons / Hr
	Cleanliness factor	0.85
	Plugging margin	5%
	Hot well retention time	2 min
	Design code	HEI (thermal)
	TEMA (Tube sheet, cover plate) CW in let temp.	
	CW out let temp.	32

CW supply pressure	2.5Kg/cm 9g)
CW side friction loss	8 mwc
Tube fixing	Expanded joints
Tube material	SS 304 ERW
Tube sheet material	IS 2062
Water box & Shell material	IS 2062
<b><u>STEAM JET AIR EJECTORS</u></b>	
Main (operating ejector) Design code	HEI /TEMA
Suction medium	Air / Vapour
No. of Ejector	2X100% capacity
Nos. of stages/unit	2
Design capacity per Element	100%
No of Starting Ejectors	1 No,
time to reach vacuum	20 - 30 minutes
Accessory	Integral steam strainers
<b><u>Ejector Condenser</u></b>	
Plurality Ejector condenser	2 no.
Tube side medium	Condensate
Shell side medium	air / vapor
<b><u>Material of construction</u></b>	
Material of nozzle	
Material of shell & diffuser	AISI 304
Material of tubes	CS
Material of tube sheet	SS 304 ERW
Material of silencer	IS 2062
Method of tube fixing	CS

<b>13</b>	<b><u>CONDENSATE BLEED PUMPS</u></b>	Roller expanded
	Type	Centrifugal Quantity
	Capacity	
	Mounting	6.6 Tons/hour
	Suction pressure	same as condensor pressure
	Discharge pressure	30 mwc
	Driver type	AC motor (415 v, 3 Phase)
	NPSH (Min.)	2.0 Meter
	Type of coupling	Flexible
	Operating speed	2900 RPM
	Material of shaft sleeve	
	<b><u>RUPTURE DISC</u></b>	
	Type	Diaphragm
	End connection	Flanged
	<b><u>EXPANSION BELLOW</u></b>	
	Type	Corrugated
	Design code	
	Material of bellows element	SS 304
	Material of liner	SS 304
	Material of flanges	
<b>14</b>	<b><u>AC GENERATOR</u></b>	
	<b>Design:</b>	
	Reference standard	IS-4722
	Duty	Continuous
	Rated output	2000 KW / 2500 KVA
	Rated voltage	415 V +/- 5%
	Rated frequency	50 Hz + / - 3%

Combined variation of voltage & frequency	#VALUE!
Rated p.f.	0.8 (lag)
No. of phases	3 phase, 4 wire system
No. of terminals	3 FOR PHASE AND 3 FOR NEUTRAL
Connection	
Rated speed / No. of pole	
Short circuit ratio	
Ambient temperature	40 deg. C
Excitation	
AVR	machine mounted
Noise level	110 db (A) @ 1 Meter
Rotor	
Cooling method	SPDP
Mounting	Horizontal
Insulation	Class H
Temperature rise	Class H limits
Enclosure	IP-54 (Exiter)
Duty	
Rotation	
Terminal box	
Reference standard	
Harmonic loading	
<b><u>Bearings:</u></b>	
Type	Ball Bearings, totally enclosed
Accessory	
<b><u>Anti condensation heaters:</u></b>	

	Type	Resistance heating
	Power supply	
<b>15</b>	<b><u>ELECTRICAL PANELS</u></b>	
	Type	Simplex, Free standing, in 1.6 / 2 mm thickness, CRCA sheet steel, chemically treated & power coated
<b>16</b>	<b><u>BREAKER CUM RELAY &amp; METERING PANEL</u></b>	
	<b><u>AIR CIRCUIT BREAKER:</u></b>	
	Quantity	1 No.
	No. of Poles	3
	Type	E/D/O
	Rating	5000 Amps
	Breaking capacity	50 KA for one second
	Spring charging method	
	Mounting	panel front
	<b><u>CONTACTOR:</u></b>	
	Type	Electrically operated
	Rating	700 Amps
	<b><u>Relays :</u></b>	
	Type	Electronic areva make micom P343
	Earth Fault + Over current	One No.
	Under / over voltage	One No. (Base mounted)
	Under / over frequency	One No. (Base mounted)
	Generator master trip	One No.
	Auxiliary Relays	One Set
	<b><u>Meters:</u></b>	

Type	Digital
System	3 phase, 4 wire
Reference standard	IS-1248
Ammeter	3 Nos.
Voltmeter	1 no.
Frequency meter	1 no.
kW / PF / kVA / kVAR meter	1 no.
kWH meter	1 no.
Trivector meter	
<b><u>Current transformers:</u></b>	
Type	Resin cast
<b>Protection CTs:</b>	
Ratio	4000 / 5 A
Class	5P10
Burden	15 VA
Quantity	3 Nos.
<b>Protection CTs:</b>	
Ratio	4000 / 5 A
Class	PS
Burden	15 VA
Quantity	3 Nos.
<b>Protection CTs (Earth Fault)</b>	
Ratio	2000 / 5 A
Class	5P10
Burden	30 VA
Quantity	1 No.
<b>Metering CTs:</b>	

	Ratio	4000 / 5A
	Class	1
	Burden	15 VA
	Quantity	3 nos.
	<b><u>Busbars:</u></b>	
	Material	Aluminium EC-91E grade
	<b><u>Indicating lamps :</u></b>	
	Breaker on/off positions	2 Nos.
	Neutral Isolator Switch on/off positions	2 Nos.
	Incoming bus bar live	3 Nos.
	Outgoing bus bar live	3 Nos.
	Aux. AC Supply on	1 No.
	DC supply on	1 No.
	<b><u>Alarm Annunciator:</u></b>	
	For	Fault monitoring
	Power supply	24 V DC
	No. of windows	As required
	Accessories	Push buttons for TEST, ACK. & RESET and hooter
	Fault initiation	Make to alarm
<b>17</b>	<b><u>SYNCHRONIZING PANEL</u></b>	
	Panel Construction	
	Enclosure	
	<b>Synchronizing Components</b>	
	Auto Synchronizer	Woodward Make SPMD-10
	Manual Synchronizer with inbuilt Digital Double Voltmeter, Double frequency meter, Synchronoscope and Check Relay	1 No.



	<b>Potential Transformers</b>	
	IVT 415/110 VAC	2 Nos.
	RVT 110/110 V AC	1 No.
	<b>Accessories</b>	
	Control Switches for Breaker Selection, Auto Manual Selection, Synchronizing On/ Off, Live / Dead selection, Course / Fine Selection & TNC Switch For Breaker Closing	1 Lot
	Indication Lamps, Synchronizing Lamps	As Req.
	Push Buttons for Speed /Voltage Raise / Lower	As Req.
	Panel Space heater with Thermostat	1 No.
	Panel Illumination lamp	1 No.
<b>18</b>	<b><u>BATTERY CHARGER CUM DC DISTRIBUTION PANEL</u></b>	
	<b><u>Battery charger:</u></b>	
	Type	Float, Float cum Boost charger
	Input	240 V, 1 phase, 50 Hz, Ac supply
	Output	15 A, 110 V DC
		25 A, 24 V DC
	Voltage regulation	+/- 1% (no-load to full load) Operation mode
	DC to DC Converter	110 V / 24 V DC
	Operation mode	
	<b><u>DC Distribution:</u></b>	
	DC motor starter panel	1 No.
	Breaker cum Relay panel :	1 No.
	Turbine control panel	1 No.
	To Actuator	1 No.

	Spare	2 Nos.
	<b><u>Accessories:</u></b>	
	Voltmeter	2 Nos.
	Ammeter	1 No.
	Hooter	1No.
	Indicating lamps	5 No.
	Selector Switch	2 No.
	MCBs	1 Set
	Terminal Blocks	1 Set
<b>19</b>	<b><u>BATTERY</u></b>	
	Type	Lead acid, Sealed & Maintenance Free
	Capacity	100 AH
	Rating	110 V,DC
	Volt per cell	2V, DC
	No.of cell	6
	No. of batteries	9 Nos.