TECHNICAL SPECIFICATION

FOR

GYPSUM DEWATERING SYSTEM

CONFIDENTIAL

CUSTOMER	**: M/s. BIFPCL Bangladesh**
PROJECT	**: Maitree 2X660MW**
APPLICATION	**: FLUE GAS DESULPHURIZATION SYSTEM**
TENDER REF	**: BIFPCL: MAI: FGD: GDS: R00**

BHARAT HEAVY ELECTRICALS LIMITED
(A GOVT OF INDIA UNDERTAKING)
Flue Gas Desulphurization Group
Ranipet

TECHNICAL SPECIFICATION FOR GYPSUM DEWATERINGSYSTEM

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1.0 PROJECT INFORMATION:

a.	Owner	BIFPCL (BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED), Bangladesh
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization

Bangladesh-India Friendship Power Company (Pvt.) Ltd. (BIFPCL) is a 50: 50 Joint Venture Company of Bangladesh Power Development Board, Bangladesh (BPDB) and NTPC Limited, India (NTPC), incorporated under the laws of Bangladesh. BPDB is a statutory body constituted under the Bangladesh Water and Power Development Board Order 1972, and is vested with a significant portion of the generation and distribution of electricity in Bangladesh. NTPC Limited is a Maharatna company incorporated under the Indian Companies Act, and as India's largest power company, has a diversified portfolio covering the entire value chain of the power generation business. Pursuant to the implementation agreement dated April 20, 2013, as entered into between the Government of the People's Republic of Bangladesh, and BIFPCL, and the power purchase agreement also dated April 20, 2013, as entered into between BIFPCL and BPDB, BIFPCL has entrusted BHEL the development of the Coal fired 2x660 MW Maitree Super Thermal Power Project on Turnkey Basis at Rampal, Dist.-Bagerhat, Bangladesh, on the bank of river Possur, Bangladesh, for the purposes of supply and sale of electric power to BPDB. Wet Limestone FGD System is also envisaged by customer in this project to control SO_2 Emissions from the power plant. For the purposes of setting up the Wet Limestone FGD System for 2x660 MW Coal fired Power project at Rampal, BHEL is inviting bids from suitably qualified Bidders for Gypsum Dewatering system, pursuant to and in accordance with these bidding documents.

A) SITE CONDITIONS

1.	**Ambient Temperature and Relative Humidity**		
a.	**Average Site Condition ASC**		
	Ambient Temperature	:	27.3 deg C
	Ambient Humidity	:	87%
	Ambient Pressure	:	1007.6 mbar
b.	**Summer Site condition SSC**		
	Ambient Temperature	:	36.9 deg C
	Ambient Humidity	:	60%
	Ambient Pressure	:	1007.9 mbar
c.	**Winter Site condition WSC**		
	Ambient Temperature	:	12.2 deg C
	Ambient Humidity	:	100 %
	Ambient Pressure	:	1017.2 mbar
d.	**Reference Site condition RSC**		
	Ambient Temperature	:	31 deg C
	Ambient Humidity	:	88%
	Ambient Pressure	:	1007 mbar
2.	**Design ambient conditions for Electrical Systems**		
a.	Maximum Design temperature (outdoor)	:	45 deg C

b.	Maximum daily average ambient shade temperature	:	38 deg C
c.	Maximum monthly average temperature (in the shade)	:	34.6 deg C
d.	Maximum annual average temperature (in the shade)	:	27.3 deg C
e.	Maximum design temperature of the electrical equipment installed indoors in air conditioned rooms	:	40 deg C
f.	Maximum design temperature of the electrical equipment installed indoors in non-air conditioned rooms	:	45 deg C
g.	Minimum design temperature	:	0 deg C
3.	**Plant Elevation**	:	+5.0 m above sea level
4.	**Wind Load**	:	As per Bangladesh National Building code-2012, Part-6, Chapter 2.4
a.	Basic Wind speed, three-second gust at 10m above ground in exposure C, having a return period of 50 years	:	73 m/s, Exposure category-"C"
5.	**Seismic Load**	:	Seismic Zone 1 as determined by Bangladesh National Building code (BNBC-2012)

Note:

1) Reference site conditions shall apply for the Guarantee Values as well as for the Guarantee test/Performance test

2) Equipment and Material must be suitable for the range of ambient site conditions. In particular the saline atmosphere has to be considered.

B) PROJECT LOCATION AND APPROACH

a.	State/Division	**Khulna**
b.	District	Bagerhat district
c.	Place	Moithara Village, Rampal Upazila
d.	Location	Latitude- 22 deg 37" 0" to 22 deg 34" 30"N Longitude- 89 deg 32'0"E to 89 deg 34'5"E

C) APPROACH TO SITE:

The nearest town Khulna is at a distance of 23 km from project site. The site is connected by road from Mangla- Khulna Highway. Nearest Domestic airport is Jessor, Bangladesh at a distance of about 107 KM and international airport is Dhaka at a distance of 263 KM, Bangladesh. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given above is for general guidance and shall not be contractually binding on the Owner. Bidders shall obtain clarifications/ information, if any, before submitting their offers, regarding scope of work, facilities available at sites, etc. No additional claim shall be entertained by BHEL in future, on account of non-acquaintance of above. All relevant site data/ information as may be necessary shall have to be obtained/ collected by the Bidder.

2.0 APPLICABLE CODES & REGULATIONS

The design of Gypsum Dewatering System shall conform to the latest edition of International codes accepted by the Buyer according to good engineering practice.

List of codes/standards recommended: (The list is not exhaustive)

S.No	Description	Material	Design & others
1	Piping	AISI, ASTM,ASME,DIN,EN,BS or Equivalent	AFNOR, ANSI, API, ASME, ASTM, AWWA, BS, DIN, EN, EJMA, Manufacturer's standard
2	Machinery	AISI, ASTM,ASME,DIN,EN,BS or Equivalent	AFNOR, AFBMA, AGMA, ANSI,API, ASTM, AWS,BS, DIN, IEC, HI, HEI, ISO, NEC, NEMA, EN, TEMA, VDI, Manufacturer's standard
3	Instrumentation	AISI, ASTM,ASME,DIN,EN,BS or Equivalent	AFNOR, ANSI, API, ASME, BS, DIN, EN, IEC, IEEE, ISA, ISO, NC, Manufacturer's standard
4	Electrical	AISI,ASTM,ASME,DIN,EN,BS or Equivalent	BS, VDE, IEC, EN, ANSI,IEEE, NEMA
5	Civil	AISI, ASTM,ASME,DIN,EN,BS or Equivalent	AFNOR, ASCE, ASNT, BS, DIN, EN, ANSI, ACI,AISC,AWS, SSPC, Manufacturer's Standard
6	Structural Steel	SA/IS2062	BS/EN 1993 (Eurocode-3) or Equivalent international codes.

The design, materials, construction, manufacture, inspection, testing and performance of Gypsum Dewatering System shall also comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. It is the supplier's responsibility to fully comply with the latest version of changes in regulations, codes and standards.

If there is a conflict between this specification and a referenced document or between the codes and standards the most stringent shall apply.

3.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, testing at the manufacturer's works, delivery at site, supervision of erection & commissioning and performance testing of Gypsum Dewatering System along with accessories which is to furnished in the Flue Gas Desulphurization plant of Maitree 2x660MW project in Bangladesh. The following points may be noted.

a. There are two (2) units of each 660 MW and each unit is envisaged with one (1) FGD system. Two (02) Sets of Gypsum Dewatering system (1 working + 1 standby) for each unit shall be provided. Total Four (04) sets for both the units and are located inside the Gypsum Dewatering Building.

b. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

c. The Bidder shall offer only proven design, which meets the Provenness criteria indicated in the clause no: 4.0. Necessary document evidences as per **Annexure-III & VI** shall be submitted along with the bid. If bidder doesn't meet the specified provenness criteria, they are denied to participate in this tender.

d. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (**Annexure-IV**)".

e. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.

f. No deviation or exception shall be permitted without the written approval of the purchaser.

g. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

h. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.

i. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.

4.0 PROVENNESS CRITERIA:

The Bidders are required to meet the Qualification Requirement (QR) for Vacuum Belt Filters as per criteria stipulated below.

"Bidder to have previous experience of manufacturing, supplying, erecting and commissioning the Vacuum Belt Filters for Wet Limestone based FGD system for at least two (2) no's 500 MW or higher sized pulverized coal fired power generating units such that respective equipment(s) should have been in successful operation for a period not less than two (2) years prior to Dec 2nd 2015".

5.0 TECHNICAL INFORMATION

GENERAL DESCRIPTION OF GYPSUM DEWATERING SYSTEM

The employer envisage unitized gypsum dewatering system for each unit. The dewatering system shall receive the gypsum slurry from each absorber through slurry feed pipes and shall comprise of following dewatering equipments.

Each set (suitable for handling/dewatering of one unit) shall comprise of the following items as a minimum requirement.

i) Two Sets of Primary Hydrocyclones (1W+1S) for each unit
ii) Two Sets of Vacuum Belt Filters (1W+1S) for each unit
iii) Two No's of Vacuum receivers (1W+1S) for each unit
iv) Two No's of Vacuum Pumps (1W+1S) for each unit
v) Two Sets of Waste Water Hydrocyclones (1W+1S) for each unit
vi) Two No's of Belt filter wash Pumps (1W+1S) for each unit
vii) One No of Gypsum Reversible Conveyor for each unit
viii) One No. of Gypsum Intermediate silo –bottom extraction device for each unit
ix) Complete Piping and valves for the system along with wash water line.

Gypsum slurry (30 wt. %) produced in FGD Absorber is supplied to Primary Dewatering Hydro-cyclones by Gypsum Bleed Pumps **(BHEL Scope).** The primary hydro-cyclone shall be installed above the belt filters. The underflow from primary hydro cyclone is fed to vacuum belt filter for final stage of dewatering gypsum slurry to produce gypsum cake with Gypsum Purity >90%, moisture content less than 10% and chloride content less than 100 ppm.

The overflow from the primary set of hydro-cyclone shall be taken to a Wastewater hydro-cyclone feed tank (**BHEL Scope**). Waste Water Hydro cyclone feed pumps (**BHEL Scope**) shall transfer the slurry from tanks to Waste Water hydro cyclone feed. Filtrate Water from vacuum receiver tank and the underflow from the Wastewater hydro-cyclone shall be taken to the Filtrate water tank **(BHEL Scope).** The over flow from the Waste Water hydro-cyclone shall be taken to a Wastewater tank **(BHEL Scope).**

For belt filter cloth & Gypsum cake washing process water shall be used. For this purpose, 2x100% Belt filter wash pumps shall be provided for each Unit. One(01) stage of cloth washing, Vacuum Pump Sealing and minimum Two(02) stages of cake washing arrangement for removing impurities in the gypsum shall be provided along with 2x100% Belt Filter washing pumps for each Unit. Belt filter wash tanks are **in BHEL scope**. The vacuum Pump sealing water is collected to the Belt Filter Washing Tank.

The Gypsum Cake discharged at the Vacuum Belt Filter Outlet is conveyed to Gypsum Intermediate silo **(BHEL Scope)** through reversible conveyors. Gypsum Intermediate Silo bottom extraction arrangement shall be provided by the bidder to transfer the Gypsum cake to Pipe conveyors **(BHEL Scope).**

Gypsum Dewatering System composed of

S.No	Service	Description	Parameters	Quantity for both the units
1.	Primary Hydro cyclone A/B	Type	Vertical Hydro cyclone	(1+1)X2 = 4 No's
		Capacity	40 m^3/h	
2.	Vacuum Belt Filter A/B (Accessories with Belt Filter are included)	Type	Vacuum belt filter	(1+1)X2 = 4 No's
		Capacity	12.0 ton/h (Wet Cake)	
3.	Vacuum Receiver A/B	Type	Vertical Cylinder	(1+1)X2 = 4 No's
4.	Vacuum Pump A/B	Type	Water Ring	(1+1)X2 = 4 No's

5.	Belt Filter Vent Fan A/B	Type	Axial	(1+1)X2 = 4 No's
6.	Belt filter wash pump A/B	Type	Centrifugal	(1+1)X2 = 4 No's
		Capacity & Head	As per Bidder's standard	
7.	Waste water Hydro cyclone A/B	Type	Vertical Hydro cyclone	(1+1)X2 = 4 No's
		Capacity	22.73 m^3/h	
8.	Gypsum Diverter A/B at Belt filter outlet	Type	Belt Conveyor	(1+1)X2 = 4 No's
		Capacity	12 TPH	
9.	Gypsum Reversible Belt Conveyor A/B	Type	Belt Conveyor	1+1 = 2 No's
		Capacity	27 TPH	
10.	Gypsum Intermediate Silo-Bottom Extraction Device A/B	Type	Bottom discharge	1X2 = 2 No's
		Silo Capacity	270 m^3 (Bulk Density: 1000 kg/m^3)	
		Outlet Feed	50 TPH	
11.	Gypsum Intermediate Silo Shut-off Gate A/B	Type	As per Bidder's standard	1+1 = 2 No's
12.	Gypsum Intermediate Silo Diverter A/B	Type	As per Bidder's standard	1X2 = 2 No's

The above table is a summary of the requirements of the contract. Please refer to attached technical requirement for detailed information.

13. **POWER SUPPLY**

Bidder shall design and supply the equipment suitable for mentioned power supply condition.

1) Power Source Condition

AC	Medium Voltage SWGR		Low Voltage SWGR	
	Nominal	Range	Nominal	Range
Voltage (Steady State)	11/3.3 kV	+/- 6%	240/415 V	+/- 10%
Frequency	50 Hz	-5 to +3%	50 Hz	-5 to +3 %
Phase	3 ϕ		1ϕ for 240V, 3ϕ for 415V	
DC	Medium Voltage SWGR			
	Nominal	Range		
Voltage (Steady State)	220 V	-15 to +10%		

2) Power Distribution

		Voltage		Phase	Emergency Power Source	Note
Motor	AC	11	kV	3P		≥1500 kW
		3.3	kV	3P		≥160 kW- <1500 kW
		415	V	3P		≥0.2 kW- <160 kW
		240 / 415	V	3P		0.2 kW and under
Power outlets for welding	AC	240	V	3P		
Power outlets for portable tools	AC	240	V	3P		
Safety power outlets	AC	240	V	3P		
Lighting Distribution	AC	240	V	3P		
Normal Lighting Apparatus	-	240	V			
Emergency Lighting Apparatus	-	240	V			
Control Voltage for						
MV switch gear	DC	220	V	1P		
Motor Control Center	AC	240	V	1P		
Supply to instrumentation services						
Normal	DC/AC	220/220	V	1P	AC is supplied from UPS.	
Emergency Unit	DC/AC	220/220	V	1P	AC is supplied from UPS.	

3) Enclosure for Electrical Equipment

S.	Description	IP Category
1	Motors- Indoor	IP 54
2	Motors-Outdoor	IP 55
3	LV Switch gear	IP 54
4	Local Start Stop Push Button	IP 55
5	Field instruments	IP 65
6	Junction Box	IP 55
7	Local Control Panel	IP 54
8	Cable Connecting Box	IP 55
9	Indoor A/C or ventilated equipment	IP 41
10	Cable Box- indoor	IP 54
11	Cable box-Outdoor	IP 65

4) Design Ambient conditions for Electricals

S.	Description	IP Category
1	Maximum Outdoor Design Temperature	45 Deg C
2	Maximum Design temperature for equipments installed in A/C Rooms	40 Deg C
3	Maximum Design temperature for equipments installed in Non A/C Rooms	45 Deg C

19. **INSTRUMENTATION**

S.No	Description	Instrumentation requirement
1	Pumps	Suction and Discharge Pressure Gauges Gland Sealing Pressure Gauges (if applicable)

	2	Strainers and Filters	Differential Pressure Gauges and Differential Pressure Switches (as applicable)
	3	Heat Exchangers	Temperature gauges and pressure gauges upstream and downstream, both tube side and shell side.
	4	Lubrication and Cooling systems	Pressure gauges indicating system pressure at appropriate locations to enable correct system functioning to be confirmed. Water flow switches and indicators Oil flow switches and indicators on the outlet temperature gauges
	5	Tanks and Vessels	Level transmitters Temperature gauges
	6	Bearings	Oil level indication Bearing temperature transmitter
	Each instrument whose signals are displayed at the DCS shall have local display to the extent possible.		
	All instrumentation and related accessories, material for installation shall be provided. The connections to process piping or equipment shall be provided with root valve.		
	Bidder shall provide the cable accessory and provision for power and I&C Cable connection (such as cable gland, Terminal lug, Opening hole for terminal box, etc.,)		
	For interlock and alarm signal, double redundancy shall be supplied.		
	Cake thickness sensor shall be provided for each vacuum belt filter for measurement and controls. Double redundancy shall be applied for the cake thickness sensors.		
	Measurement serving for closed loop controls shall be provided with at least two separate sensors, detectors, transmitters.		
	The installation shall include upstream and downstream isolating valves and for control valves, a bypass valve for each control valve on all services. Bypass valve shall have a similar characteristic as the control valve and shall be accessible for maintenance. Local Pressure gauges shall be provided upstream and downstream of each control valve.		
	Bearing Temperature Transmitter for initiating alarm during when “Bearing temperature high” shall be supplied by Bidder along with local display also.		
	Bearing Cooling water Flow switch for initiating alarm during when “Cooling water flow Low” shall be supplied by Bidder(if required). In addition, sight glass shall also be provided to view the cooling water flow.		

5.1 GYPSUM ANALYSIS: (At Vacuum Belt Filter Outlet)

S.No	Description	Unit	Parameters
1.	Moisture Content (free)	wt%	**10 (Max)**
2.	Gypsum Purity	wt%-d	**>90**
3.	Cl^- (Requirement)	wt%-d	**0.01 or 100 ppm-dry**
4.	$CaSO_3.1/2\ H_2O$	wt%-d	**0.5**
5.	MgO	wt%-d	**0.1**
6.	$CaCO_3$+$MgCO_3$	wt%-d	**1.5**
7.	Al_2O_3	wt%-d	**0.3**
8.	Fe_2O_3	wt%-d	**0.15**
9.	C	wt%-d	**0.1**
10.	pH	wt%	**5 to 9**
11.	Bulk density of Gypsum	Kg/m^3	**1000 kg/m^3-Volumetric computations**
		Kg/m^3	**1250 kg/m^3-Torque & drive computations**

5.2 PROCESS WATER ANALYSIS

The following water to be used for Belt Filter cloth and Gypsum Cake wash and will be terminated in Gypsum Dewatering building.

S.No	Constituents	Unit	Water quality
1.	Total Dissolved Solids	ppm	~650
2.	Calcium	ppm	45
3.	Magnesium as Mg	ppm	5
4.	Sodium as Na	ppm	170
5.	Potassium as K	ppm	11
6.	Iron as Fe	ppm	~0.1
7.	Fluoride as F	ppm	0.02
8.	Bicarbonate	ppm	130
9.	Chlorides as Cl	ppm	270
10.	Sulphate as SO_4	ppm	8
11.	Nitrate as NO_3	ppm	0.1
12.	Silica	ppm	0.2
13.	pH		6.4 to 7.4
14.	Turbidity	NTU	<0.05

5.4 COOLING WATER ANALYSIS

The following Demineralized Cooling water (DMCW) will be used for cooling (if applicable) and will be terminated in Gypsum Dewatering building

S.No	Constituents	Unit	Water quality
1.	pH		9 to 9.5
2.	Temperature	Deg C	38
3.	TDS	Ppm	Minimal
4.	Pressure	MPaG	<0.6
5.	Maximum Allowable Temperature increase	Deg C	5 to 10 Deg C
6.	Maximum Allowable Pressure Drop.	Kg/cm^2	≤ 1.0 Kg/cm^2

5.5 INSTRUMENT AIR ANALYSIS

The following Instrument Air will be used for the system operation and will be terminated in Gypsum Dewatering building.

		Available Value			Design Value		
		Minimum	Normal	Maximum	Minimum	Normal	Maximum
Temperature	Deg.C	-	-	-	-	36.9	-
Pressure	MPaG	-	-	-	0.55	-	0.8

5.6 OPERATION PHILOSOPHY

1) The Gypsum Dewatering system consisting of Primary hydro cyclones, Vacuum belt filter associated with washing & Conveying system, Waste water hydro cyclones in closed circuit shall be operated automatically and sequentially. The provision should also be provided to start and stop the equipment by means of the push button switches located on

- Local Control Panel
- Local Push Button Station

2) Rotating machines such as pumps, conveyors, Silo extraction device etc. shall be started and stopped manually by means of local push button station.

3) Gypsum belt filter is operated by batch operation to maintain Slurry density in absorber.

6.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, Supply, Supervision of Erection & Commissioning & Performance testing of Gypsum Dewatering System.

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions commissioning procedures, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from BIFPCL/BIFPCL's consultant.

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting, packing & transportation to site, customer clearance/port clearance and any other statutory clearances, receipt at site.

Supervision of Erection, & commissioning: Includes supervision of erection & commissioning, supervision of trial operation, training of customer's O&M Personnel and handing over to customer.

Performance testing: Testing shall be conducted to prove the rated Vacuum belt filter capacity and gypsum quality at site.(Residual moisture content and Chloride content)

Supplier's scope shall cover four (04) numbers of complete Gypsum Dewatering unit including sub-systems, start-up spares and special tools (typically) as given below. The scope of supply for Gypsum Dewatering system for both the units shall include but not limited to the following:

Sl. No	Scope	Quantity for both the units
1.	Primary Hydrocyclones complete sets with	4 sets
	i. Hydrocyclone clusters	
	ii. Anchor bolts, nuts and washers	
	iii. Companion flanges for inlet and overflow	
	iv. A variety size of vortex finders for all the hydro cyclone	
	v. Accessory piping within the skid	
2.	Vacuum Belt Filter complete with	4 sets
	i. Accessories including discharge chute.	
	ii. Drivers (VFD with LCP)	
	iii. Instrumentation & any safety device	
3.	Vacuum Receiver	4 sets
	i. Anchor bolts, nuts and washers	
4.	Vacuum Pump complete with	4 sets
	i. Motor	
	ii. All connection bolts/nuts/washers for installation	
	iii. Required instruments and any safety device	
5.	Belt Filter Vent Fans complete with	4 sets
	i. Motor	
6.	Belt Filter wash pumps complete with	4 sets
	i. Motor	
	ii. Arrangement for Cloth and cake washing including spray nozzles etc.	

Sl. No	Scope	Quantity for both the units
	iii. Companion flanges and gaskets	
7.	Waste water Hydrocyclones complete sets with	4 sets
	i. Hydrocyclone clusters	
	ii. Anchor bolts, nuts and washers	
	iii. Companion flanges for inlet and overflow	
	iv. A variety size of vortex finders for all the hydro cyclone	
	v. Accessory piping within the skid	
8.	Gypsum Diverters complete with	4 sets
	i. Motor	
9.	Gypsum Reversible Belt conveyors complete with	2 sets
	i. Motor	
	ii. Spare drive in the warehouse	
	iii. Specific cleaning devices	
	iv. All connection chute with proper liner	
	v. Required instruments and any safety device	
	vi. Full closed type with opening door	
10.	Gypsum Intermediate Silo-Bottom extraction device complete with	2 sets
	i. Motor	
	ii. Instruments for Gypsum Intermediate silo	
	iii. Design, GA and Manufacturing drawings of Gypsum Intermediate Silo	
	iv. Any instrumentation and Silo accessories	
11.	Gypsum Intermediate Silo Shut-off Gates complete with	2 sets
	i. Motor	
12.	Gypsum Intermediate Silo Diverters complete with	2 sets
	i. Motor	
13.	Instruments like Pressure gauge, Flow switches, Flow control valves, Flow indicators, Bearing Temperature Transmitter, Cooling water flow switch, Temperature gauges, Cake Thickness Sensors, Level Transmitters as applicable etc.	
14.	Electric common including but not limited to	
	i. Local control panel	
	ii. LV Motors	
	iii. Junction Box	
	iv. Instruments	
	v. Push buttons	
15.	Miscellaneous (As and wherever required)	
	i. Coupling arrangement and Coupling guards	
	ii. Expansion joints at Inlet and Discharge	
	iii. Bearing cooling	
	iv. Lubrication system, Lubrication oil or grease for initial charge	
	v. Foundation bolts for supplied items	
	vi. Lifting Eye bolt or lugs	
	vii. Complete Piping within the skid	
16.	Test and Inspection at shop including but not limited to;	

Sl. No	Scope	Quantity for both the units
	i. Mechanical Running and Performance test	
	ii. Visual and Dimensional Inspection	
17.	Painting and Rust Prevention during shipment and construction	
18.	Export packing and Inland Transportation	
19.	Supervision of Erection & commissioning at site	
20.	Performance Test and Inspection at site	
21.	Special tools & tackles as applicable	
22.	Start-up & Commissioning spares as applicable	
23.	Installation, operation and maintenance manuals	
24.	Bidder to quote for the Initial Spare parts (Mandatory Spares) with breakup price.	
25.	Bidder to quote for the Recommended Spare Parts (for 24 months operation) with break up price.	
26.	Any other items required for completeness of the equipment except the items covered in the exclusions.	

6.1	TECHNICAL REQUIREMENTS
6.1.1	GENERAL
1.	Noise level by any equipment individually or collectively shall not exceed 85 dB(A) measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor. Predicted sound pressure levels for the pump drive assemblies shall be submitted as part of the proposal data.
2.	The Bidder shall guarantee the vibration stipulated by ISO 10816.
3.	The Bidder shall guarantee the consumption of electric power, process water and cooling water (if any).
4.	The Gypsum Dewatering system shall be capable of 24 hours operation per day and 7 days operation per week. The Gypsum dewatering system shall also be designed and constructed to allow intermittent operation in daytime basis.
5.	The location of Gypsum dewatering system is inside the building.
6.	The Gypsum dewatering system shall be equipped to automatically drain and vent all non-free draining slurry piping upon shutoff of flow to the piping leg.
7.	The Bidder shall design and provide facilities to prevent large particles or inert from causing equipment damage, nozzle and pipe plugging in Gypsum dewatering system.
8.	While the Gypsum dewatering system is out of service, the equipments such as Hydro cyclones, pumps and the rest shall be switched off as much as possible taking the minimization of start-up/shutdown time into account.
9.	Special attention shall be paid to the Gypsum dewatering system design so that the system in operation and/or in standby status will not have any trouble caused by the slurry characteristics such as abrasion and settling. The Bidder shall clarify the measures to protect the Gypsum dewatering system from such troubles.
10.	The Gypsum dewatering system shall be designed so that it uses only process water for belt washing, cake washing, pump seals and the rest.

11.	The Bidder shall design so that the Gypsum Dewatering system and their auxiliary equipments including open space for maintenance can be accommodated by the building as per plan shown in Annexure-XIII-GA Drawing of Gypsum Dewatering Building.
6.1.2	**DESIGN AND CONSTRUCTION REQUIREMENTS OF INDIVIDUAL EQUIPMENT**
A)	**PRIMARY HYDROCYCLONE**
i.	Each set of primary hydro-cyclone shall be provided with 10% spare hydro-cyclones. The capacity defined shall be met with spare hydro cyclones out of service.
ii.	The primary hydro-cyclone shall be installed above the belt filters. The slurry leaving the hydro cyclone stations shall have a solid content of 45%.This slurry shall be fed to the vacuum belt filter. In parallel it shall be possible to discharge the slurry into the Gypsum area drain sump**(BHEL Scope)**
iii.	The hydro-cyclone shall be of proven design. Hydro-cyclones shall be of modular construction. The primary hydro-cyclone shall be made up of polyurethane or urethane materials. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Each single hydro cyclone shall be provided with isolation valves and shall have a separate hand valve for operation and maintenance purposes.
iv.	The feed chamber shall be provided with a minimum rubber lining thickness of 12mm. The liners shall have a minimum wear life of not less than 7000 hrs.
v.	Hydrocyclones shall be temperature resistant. Hydrocyclone nozzles shall be designed of plastic for commissioning and when the appropriate dimensions are found designed of wear resistant ceramics. Hydro cyclone shall be mounted in multiple annular distributors
vi.	**Design Conditions of Primary Hydro cyclones:**

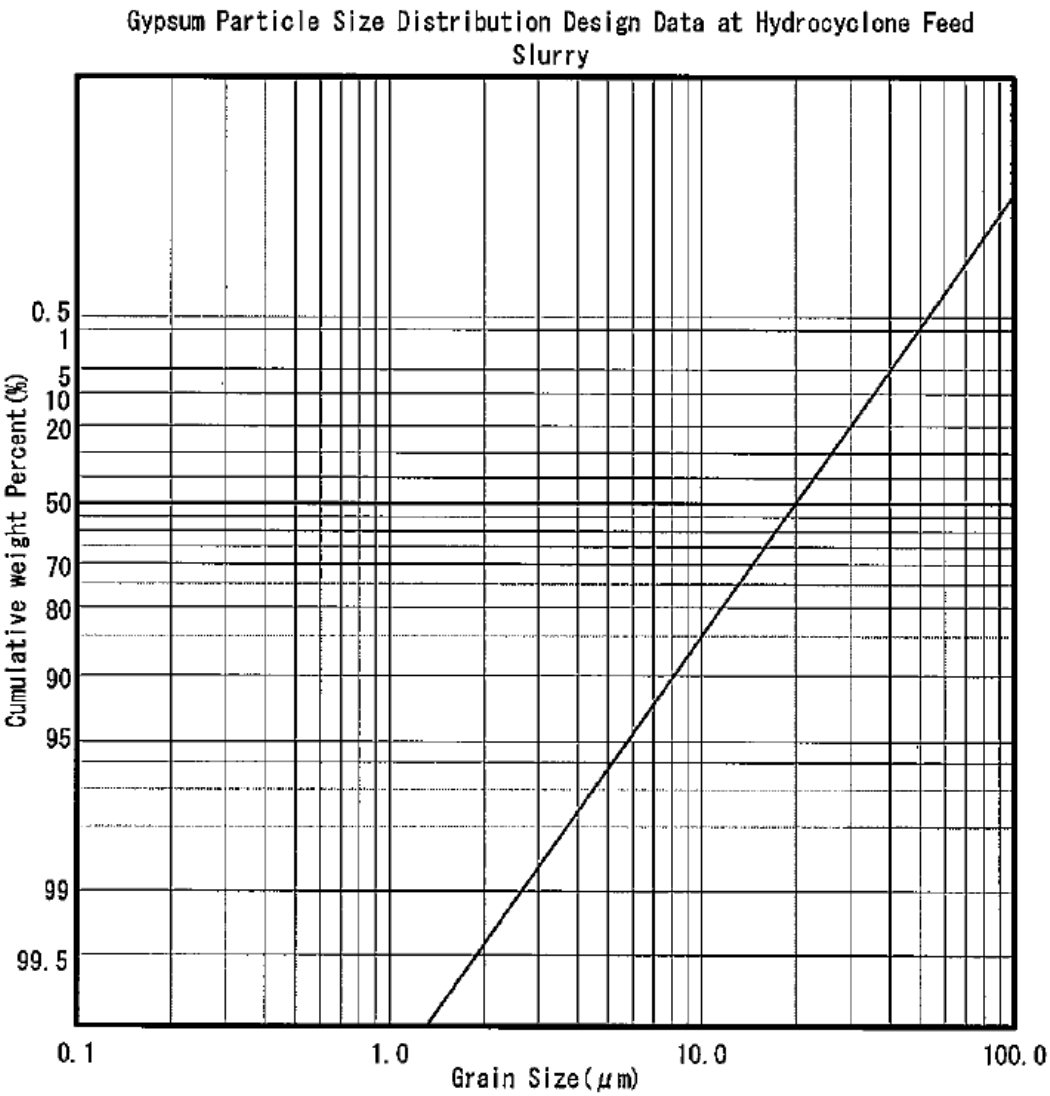
Sl.no	Description	Quantity for both the units
1.	Number of Hydro cyclone	4 sets (2 Working+2 Standby)
2.	Design Capacity	40 m^3/hr. each
3.	Material (MOC) of Cyclone Clusters	Polyurethane or urethane
4.	MOC of Feed chamber	CS+12 mm rubber lining
5.	MOC of overflow chamber	CS+12mm rubber lining
6.	MOC of under flow chamber	CS+12mm rubber lining

vii.

PROCESS PARAMETERS @ OPERATING POINT –PRIMARY HYDRO-CYCLONES

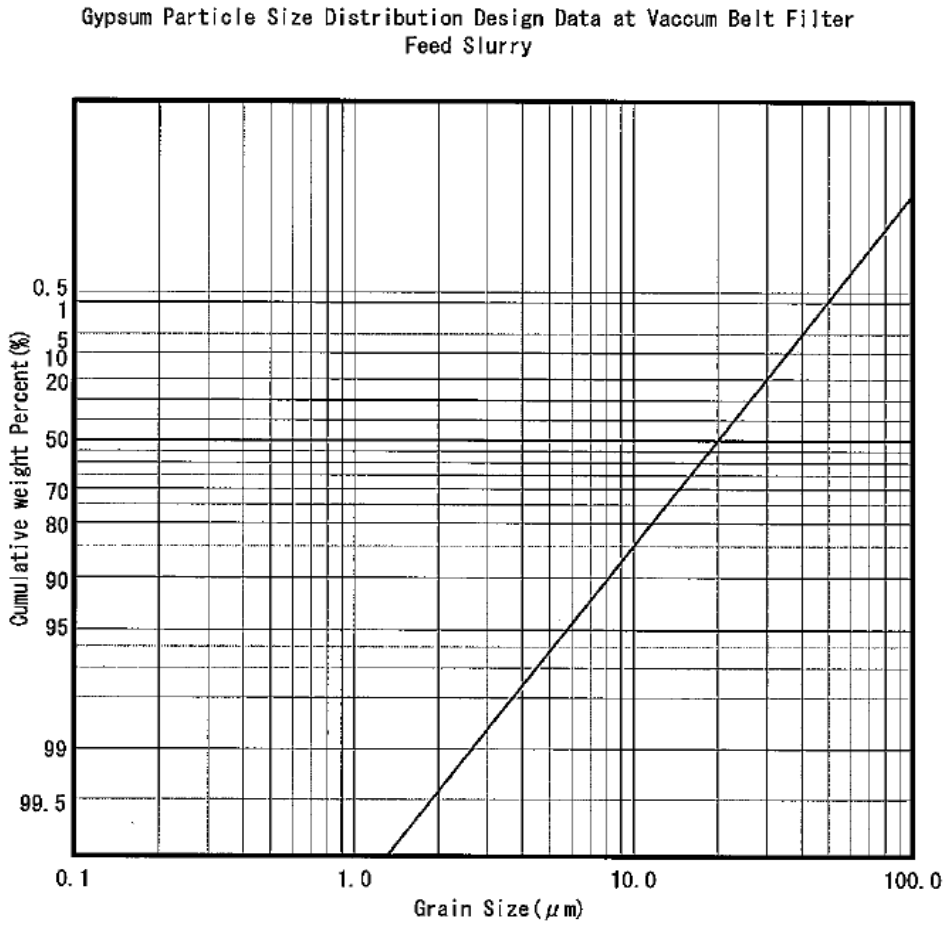
S. No.	Parameters	Primary Hydro Cyclone Feed Slurry	Primary Hydro Cyclone Over Flow	Primary Hydro Cyclone Under Flow
1.	Total Flow (m^3/hr.)	39.4	22.73 *1)	16.7 *1)
2.	Total Flow (t/hr.)	47.8	25.2 *1)	22.6 *1)
3.	Temp (Deg C)-Operating	54.7	54.7	54.7
4.	Temp (Deg C)-Design	70	70	70
5.	Slurry conc. (wt. %)	30	16.6 *1)	>45 *2)
6.	Density (Kg/m^3)	1211	1109 *1)	1351 *1)
7.	pH	4-7	4-7	4-7
8.	Cl^-(mg/l)	<27,000	<27,000	<27,000

*1) shall be finalized by vendor *2) Shall be guaranteed by vendor

viii.	
B)	**VACUUM BELT FILTERS**
i.	The secondary dewatering shall be done with two (02) vacuum belt filters designed for continuous operation. The design shall allow automatic switch over from one filter to the other filter. The filter shall be equipped with gypsum washing facilities to lower the chloride content of the gypsum.
ii.	The Vacuum Belt Filters shall have the following characteristics: a) Very rigid frame and rolls, no deformation whatsoever may occur. b) All rolls shall be installed perfectly horizontally c) There shall be no vacuum under the slurry deposition zone. d) Deposit thickness control and directional stability control e) The slurry shall be put on the belt in counter current relative to the rotation of the band. f) The vacuum chambers shall be easily opened for inspection and cleaning.

	g) The gypsum dewatering building shall be sufficiently vented to reduce the humidity in the hall by providing belt filter vent fan for each belt filter. h) Each Vacuum belt filter and piping system shall consist of drainage equipment systems, receivers and shall be stress-free supported.
iii.	The vacuum belt filter shall be proven design in operation for similar capacities. The filter cloth shall be polyester or polypropylene as per the proven design of the supplier and shall be guaranteed for a minimum life of not less than 7000 hrs.
iv.	The complete frame of the filter and all parts in contact with gypsum shall be made of corrosion resistant material or shall be provided with corrosion resistant liners of proven design. A 2m (Min.) wide platform will be necessary around each belt filter for easy operation and maintenance. The elevation of discharge point of vacuum belt filter shall be as per Annexure-XIII-GA Drawing of Gypsum Dewatering Building. Any changes shall be suggested by Bidder accordingly.
v.	In case, the bidder offers a design with an underlying belt for carrying the filter cloth, the same shall be endless, factory vulcanized rubber belts. The belt shrouds and the sealing belts shall provide a leak tight arrangement to prevent overflow of gypsum slurry. The sealing belt shall have minimum life of not less than 7000 hrs.
vi.	The vacuum box shall ensure tight sealing with the belt/cloth and shall be of proven design.
vii.	The belt filter shall have an automatic cloth tracking mechanism and shall be provided with all required instrumentation as per the bidder's proven practice. The belt filter shall have an automatic cloth tensioning mechanism. Pull chord switches shall be provided for each vacuum belt filter. Four (04) no's of Belt sway switches shall be provided for each vacuum belt filter. Cake thickness sensors with double redundancy shall be provided for each vacuum belt filter which shall control the speed of the vacuum belt filter in turn.
viii.	For cake & cloth washing only process water shall be used. The filter shall be provided with minimum 2 stages of cake washing for removing impurities in the gypsum. One stage of cloth washing arrangement shall also be provided. To meet the cake & cloth wash requirement, 2x100% belt filter wash pumps shall be provided for each Vacuum Belt Filter. Belt filter wash tanks are in BHEL Scope.
ix.	One (01) no. of Differential Pressure indicator shall be provided at the discharge line of Belt filter wash Pump for each vacuum Belt filter. Two (02) no's of Flow indicator shall be provided for cloth washing line of each vacuum belt filter. Two (02) no's of Flow indicator shall be provided for cake washing line of each vacuum belt filter.
x.	The filtrate from gypsum slurry and from cake & cloth washing shall be taken to vacuum receiver tank(s) as per the proven practice of the supplier. Each belt filter shall have an independent vacuum pump. A local pressure gauge and transmitter with diaphragm seal and capillary shall be provided for monitoring and operating of each Vacuum Receiver.
xi.	Gypsum cake from each belt filter shall be discharged through a diverter onto reversible belt conveyor. 2x100% reversible belt conveyor shall be provided for both the units. Gypsum shall be conveyed with a reversible belt conveyor to the intermediate gypsum silo and loading facilities or to the Gypsum Emergency shed **(BHEL Scope)** in case of Gypsum not meeting the specification requirements. The conveyor shall be equipped with all necessary gypsum specific cleaning devices for reliable operation. The conveyor shall be supplied with a spare drive in the

<table>
<tr><td></td><td>warehouse.</td></tr>
<tr><td>xii.</td><td>Local control panel shall have display on the front panel and necessary electrical parts.</td></tr>
<tr><td>xiii.</td><td>The service factor of the gear unit (if any) shall be minimum 1.5.</td></tr>
<tr><td>xiv.</td><td>Piping and wiring within the skid should be in the vendor’s scope.</td></tr>
<tr><td>xv.</td><td>All client end connection flanges shall be ANSI B 16.5/AWWA</td></tr>
<tr><td>xvi.</td><td>Design Conditions of Vacuum Belt Filter:
<table>
<tr><th>Sl.no</th><th>Description</th><th>Quantity for both the units</th></tr>
<tr><td>1.</td><td>Number of vacuum belt filters</td><td>4 sets (2 Working+2 Standby)</td></tr>
<tr><td>2.</td><td>Design Capacity</td><td>12.0 TPH (wet cake) each</td></tr>
<tr><td>3.</td><td>Inlet solid concentration</td><td>45%</td></tr>
<tr><td>4.</td><td>Gypsum Purity</td><td>>90%</td></tr>
<tr><td>5.</td><td>Outlet gypsum cake moisture content</td><td><10%</td></tr>
<tr><td>6.</td><td>Outlet gypsum cake chloride content</td><td><100 ppm</td></tr>
</table></td></tr>
<tr><td>xvii.</td><td>PROCESS PARAMETERS- @ OPERATING POINT - VACUUM BELT FILTER:
<table>
<tr><th>S.No</th><th>Parameters</th><th>Belt Filter Feed Slurry</th><th>Product Gypsum</th><th>Filtrate</th><th>Washing Water *</th></tr>
<tr><td>1.</td><td>Total Flow (m^3/hr)</td><td>16.7 *1)</td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Total Flow (TPH)-Wet</td><td>22.6 *1)</td><td>12.0</td><td></td><td></td></tr>
<tr><td>3.</td><td>Temp(deg C)-Operating</td><td>54.7</td><td></td><td></td><td></td></tr>
<tr><td>4.</td><td>Temp(deg C)-Design</td><td>70</td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>Solid conc. (% wt)</td><td>>45 *2)</td><td>> 90 *2)</td><td><0.2</td><td></td></tr>
<tr><td>6.</td><td>Slurry density (kg/m3)</td><td>1351 *1)</td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>pH</td><td>4-7</td><td>5~8</td><td></td><td></td></tr>
<tr><td>8.</td><td>Cl^-</td><td><27,000</td><td><100 ppm *2)</td><td></td><td></td></tr>
</table>
*1) shall be finalized by vendor *2) Shall be guaranteed by vendor
Belt filter and the peripherals shall be designed at 12.0 TPH (wet) discharge of product gypsum
Quantity of water for Vacuum Pump Sealing, Filter washing and Gypsum cake washing shall be finalized by the Bidder.</td></tr>
</table>

xviii.	
C)	**VACUUM SYSTEM**
i.	The filtrate from each belt filter, cake washing & cloth washing shall be taken to receiver tank(s) as per the supplier's proven practice.
ii.	Each belt filter shall be provided with an independent vacuum pump sized to meet the requirements of the belt filter operating at its maximum capacity. An additional margin of 10% (min.) over the above capacity shall be provided for each vacuum pump.
iii.	For each vacuum belt filter the vacuum pump shall be installed close to the vacuum belt filter. Each Vacuum pump shall have its own piping system, which connects the pump with the associated vacuum belt filter. Bidder to provide Equipment layout and GA of Gypsum dewatering building along with the offer.
iv.	**VACUUM PUMP**
a.	The vacuum pump shall be of low speed liquid ring type of proven design. The design of the vacuum pumps shall avoid cavitation under all operating conditions. The seals shall be of proven design. Vacuum Pump sealing water is to be supplied by Belt filter wash pumps and the seal water shall be returned to Belt Filter wash tank. One (01) no. of Flow Switch (with local indication) shall be provided at the inlet of each Vacuum Pump sealing line.
b.	Silencers shall be provided, if required, to limit the noise level to values stipulated elsewhere in this specification.

c.	The vacuum receiver and pump internals shall be suitably lined to protect against the corrosive environment. The material selected for vacuum pumps & vacuum receivers shall be proven for similar application.
d.	Each vacuum receiver tank(s) shall be provided with slide plate type pneumatic vacuum breaker. The plate shall be stainless steel with a min. thickness of 3 mm.
e.	Vacuum Pump vent shall be taken to the outdoor by the bidder.
D)	**COMMON REQUIREMENTS FOR PUMPS (VACUUM PUMP & BELT FILTER WASH PUMPS)**
i.	All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The bidder can also offer a Hi-chrome alloy lined pump, Carbon steel /C.I lined with highly alloyed stainless steel, a Silicon Carbide impeller and SiC lining for casing if the bidder has supplied a similar pump for a previous installation for similar service. The material used by the contractor shall be proven in previous installations.
ii.	The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption. The shaft shall be supported on heavy-duty ball/roller bearings.
iii.	All pumps shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shut off pressure under maximum suction pressure conditions.
iv.	Product water flushing lines and drains are to be supplied for each pump handling the prevailing water to avoid corrosion if the pump is out of operation for extended periods.
v.	Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate. The NPSH Values are to be referred to the least favorable operating conditions- lowest atmospheric pressure, lowest level of water on the suction side of the pump and highest temperature of the pumped fluid. An adequate safety margin of normally greater than 1m to the max NPSH required shall be provided.
vi.	All pumps shall be fitted with suction and discharge pressure gauges. Pressure gauges shall be with diaphragm seal for slurry application. Pressure gauges for other medium shall be with gate valves. All the wetted parts shall be SS316 or equivalent.
vii.	Venting valve shall be fitted to all pumps at suitable points on the pump casing unless the pump is self-venting due to the arrangement of the suction and discharge nozzles. Drainage facilities shall be provided on the pump casing or adjacent pipe work to facilitate the dismantling of pumps.
viii.	Design pumps not to be damaged during reverse rotation at up to 150% of design RPM, at full discharge head in the event that a pump trips while the other operating pump remain on line.
ix.	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off. Shut-off head should be minimum 125% of Best Efficiency Point (BEP).
x.	Selection of Duty point should preferably be at BEP (Best Efficiency Point) or slightly at the left of BEP. Selection of Duty point beyond 115% of BEP will not be acceptable. It should be noted that head variation is due to level variation in tank. Pump has to run in the system without compromising its NPSH requirement at lowest water level in tank. Hence, when tanks are filled-up and are at normal water level, pump will operate at the right of BEP, pump's operating zone should be considered accordingly.
xi.	External flushing is required to remove the accumulated particles and all related information should be mentioned in data sheet.

xii.	Pump should have adjustment provision of axial clearance between casing and impeller for maintenance of performance at best efficiency when there is wear in between impeller and casing.
xiii.	In case rubber or nonmetallic linings are used, these will be two piece molded under pressure and adjusted to the screwed metallic clamping which have been welded to the casting.
xiv.	Each pump will have a coupling of adequate size, designed for full load and capable of supporting start –up on overload moments. Each half of the coupling will be factory mounted and locked to its shaft. The coupling must be able to accept the adjustment of the impeller.
xv.	The pumps shall have mechanical seals of cartridge type with self-lubrication sliding ring cartridges. The static part will be mounted on the seal plate with circumferential ring (O-ring) or another flexible sealing ring. Built in seal design will not be accepted.
xvi.	The sealing areas shall be designed in such a way so that solids do not precipitate in them or affect the cooling or affect the adjustment and mechanical functioning of the seals. Seals which do not need jet cleaning are preferred.
xvii.	Pump induced vibration due to flow pulsations shall be avoided through suitable design.
xviii.	Each rotating equipment shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).
xix.	All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 25000 hrs.
xx.	Coupling halves shall be machine matched to ensure accurate alignment. Couplings must have a rated capacity of at least 120% of the maximum potential power transmission requirement.
xxi.	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type. Coupling shall be of flexible type made of cast steel. The bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the pump and the motor by bidder. The coupling between shafts shall be so designed that they become tight during pump operation.
xxii.	A common base plate shall be provided for pump assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting pump.
xxiii.	Pump manufacturer is to supply base plate along with Foundation bolt & Nut, “Taper wedge” and the necessary fastener for Pump and Motor with Base plate. Even if Motor is excluded from their scope, necessary fastener for motor foot with base plate will remain in pump scope of supply in order to avoid any problem.
E)	**WASTE WATER HYDRO-CYCLONE**
i.	Each set of Waste Water hydro-cyclone shall be provided with 10% spare hydro-cyclones.
ii.	The hydro-cyclone shall be of proven design. Hydro-cyclones shall be of modular construction.

The Waste Water hydro-cyclone shall be made up of polyurethane or urethane materials. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Individual isolation valve shall be provided for each hydro-cyclone for this purpose.

iii. The feed chamber shall be provided with a minimum rubber lining thickness of 12mm. The liners shall have a minimum wear life of not less than 7000 hrs.

iv. For discharging waste water from the FGD Plant with low solid content a waste water hydro cyclone station shall be supplied. The Hydrocylones shall be mounted in multiple annular distributors.

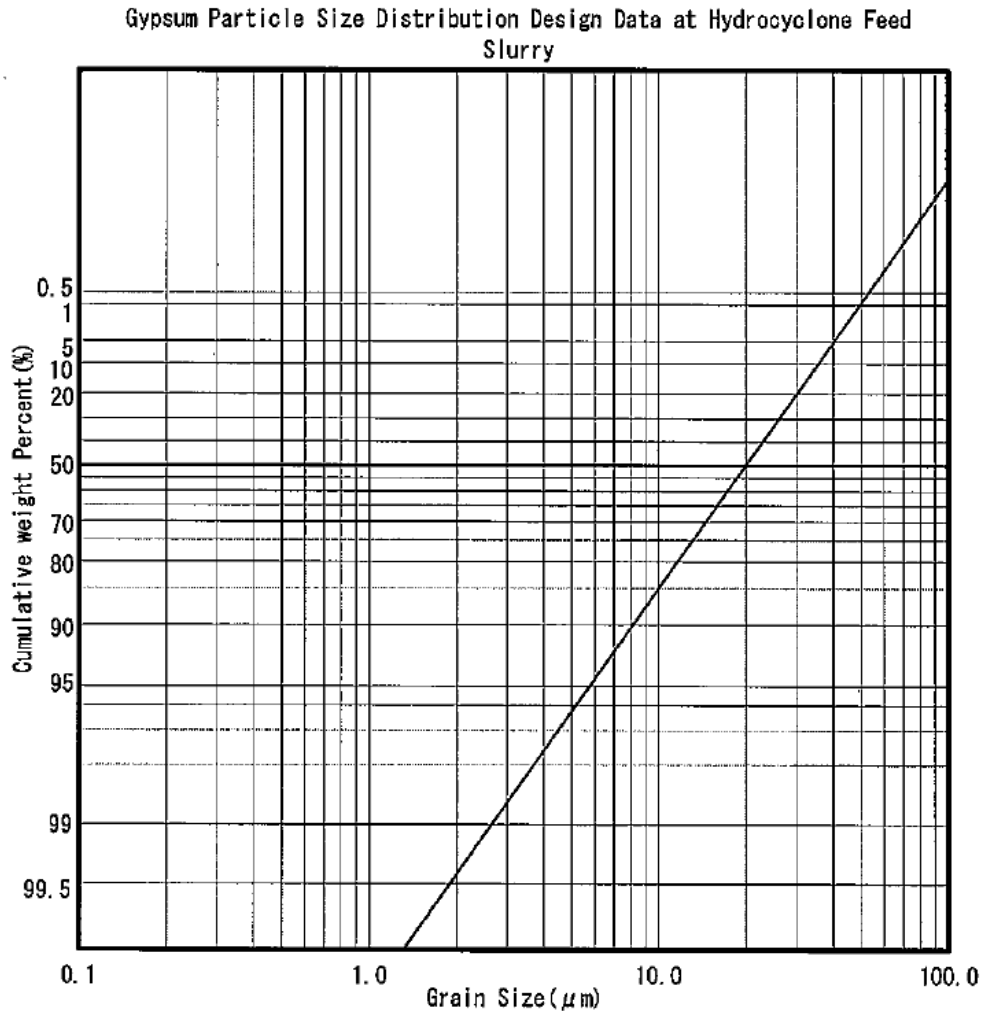
v. **Design Conditions of Waste Water Hydro cyclones:**

Sl.no	Description	Quantity for both the units
1.	Number of Hydro cyclone	4 sets (2 Working+2 Standby)
2.	Design Capacity	22.73 m3/hr. each
3.	Type of hydro cyclone	Vertical
4.	Material (MOC) of Cyclone Clusters	Polyurethane or urethane
5.	MOC of Feed chamber	CS+12 mm rubber lining
6.	MOC of overflow chamber	CS+12mm rubber lining
7.	MOC of under flow chamber	CS+12mm rubber lining

vi. **PROCESS PARAMETERS- @ OPERATING POINT –WASTE WATER HYDROCYCLONES**

Sl No	Parameters	Waste Water Hydro cyclone – Feed Slurry	Waste Water Hydro cyclone– Overflow	Waste Water Hydro cyclone – Under flow
1.	Total flow (m^3/hr)	22.73 *1)	12.3*1)	8.6*1)
2.	Total flow (t/hr)	25.2 *1)	12.5*1)	10.8*1)
3.	Temp (° C)-Operating	54.7	54.7	54.7
4.	Temp (° C)-Design	70	70	70
5.	Slurry conc. (wt. %)	16.6 *1)	< 3 *2)	35 *1)
6.	Density (kg/m^3)	1109 *1)	1021*1)	1255 *1)
7.	pH	4-7	4-7	4-7
8.	Cl- (mg/l)	<27,000	<27,000	<27,000

*1) shall be finalized by vendor *2) Shall be guaranteed by vendor

vii.	
F)	**COMMON REQUIREMENTS FOR HYDRO CYCLONES (PRIMARY AND WASTE WATER) CLASSIFIER**
i.	The hydro cyclone system shall include a hydro cyclone manifold system with cyclones, isolation valves, feed distributor, overflow and underflow collection launders, piping, and structural steel support structure.
ii.	Replaceable (rubber, polyurethane, ceramic or other suitable material) liners of not less than 12 mm thickness shall be provided. Feed and overflow shall be flange connections. The cone angle shall not be larger than 20°. Manually adjustable rubber apex nozzle shall be provided for initial operation. Ceramic apex orifice shall be furnished and installed after determination of the ideal orifice size(s). Apex Nozzle shall be ceramic.
iii.	Hydro cyclone shall be arranged in a circular configuration and fed from a cylindrical feed chamber, completely lined with rubber, with flange connections to the classifiers. The feed chamber shall contain no internal partitions, baffles, and/or obstructions. The feed chamber diameter and height above of the outlet nozzle shall be a minimum of 1.5 times of the inlet feed pipe diameter. The feed chamber shall be designed to provide uniform and constant inlet pressure to each classifier. A full diameter domed cover attached by flange connections shall be provided for inspection and maintenance. Feed piping connection shall be from below the feed chamber.
iv.	The classifier set shall have sufficient redundancy. A minimum 10% spare hydro cyclones shall be provided in each set of classifier.

v.	A local pressure gauge and transmitter with diaphragm seal and capillary shall be provided for monitoring and operating of the feed chamber pressure.
vi.	Maximum feed velocity shall not exceed 3 m/sec.
vii.	The overflow discharge pipe shall be able to discharge the total feed volume at a flow velocity of less than 2.4 m/sec. Piping connection shall be flanged. All wetted surfaces shall be lined with chloro-butyl rubber.
viii.	The underflow launder discharge pipe shall be able to discharge the feed volume at not more than 2.4 m/sec.
ix.	The hydro cyclone shall be independently supported with no interference for vertical removal. Feed connections shall have individual isolating valve.
x.	The overflow launder shall be located around the feed manifold. All wetted surfaces shall be lined with 12 mm minimum thickness rubber.
xi.	The underflow launder shall be located underneath the classifiers and overflow launder and around the feed distributor.
xii.	The hydro cyclone shall be designed to prevent splashing of slurry from the launders. A curtain or similar device is acceptable.
xiii.	The bidder shall provide the rubber apex nozzles for commissioning in hydro cyclone.
xiv.	Pinch valve (manually operated) shall be provided at the feed inlet of each hydro cyclone cluster.
xv.	Hydro cyclone underflow and overflow piping shall be installed with a suitable angle of inclination to prevent any clogging.
G)	**GYPSUM REVERSIBLE CONVEYORS**
i.	2x100% Reversible conveyors shall be provided for both the units. Each Conveyor shall be provided with a local emergency stop pushbutton, local test push button with lockout provision, remote operation, and a feeder discharge plug switch and alarm.
ii.	The reversible belt conveyor shall be designed as horizontal belt conveyor. Belt conveyor sag shall be maintained at less than 1.5 percent of the idler spacing. Belts shall be continuous and have abrasion resistant covers.
iii.	Head pulley shall be of the crowned design with lagging.
iv.	Skirt plates of abrasion & corrosion resistant shall be provided at the inlet feed box.
v.	Conveyor inlet chute shall be abrasion & corrosion resistant.
vi.	Conveyor shall be totally enclosed.
vii.	Two tracking switches shall be provided on each side of the belt.
viii.	Tail pulley shall be spiral wrapped.
ix.	The conveyor driver enclosures shall be designed to prevent accumulation of dust and moisture, and to utilize access doors and grease pipe extensions.
x.	The conveyor shall be designed to deliver the required rate of flow regardless of the type of gypsum being handled.
xi.	Each belt conveyor shall be complete with all types of idler/ belting/ pulley assemblies/ drive unit/ take-up device/ deck plate/ skirt board/ primary & secondary belt scrapers/ V-plow

	cleaners/ discharge chute/ stringer/ short post with base plate/ seal plate/ all types of safety switches/ all hardware etc. Bidder shall ensure that all bought out items viz. gear box, motor, coupling, belting etc are reputed, proven and approved make.
xii.	All Conveyors shall be capable of starting fully loaded. All inclined Conveyors shall be provided with holdback device. As an additional safety, each inclined Conveyor shall also be provided with brake. Brake shall also be provided on conveyors where coasting time is to be adjusted.
xiii.	**Belting:** The belting shall be of either synthetic fabric such as Nylon-Nylon/Polyster- Polyamide, Steel Cord. etc. with rubber covers of adequate flexibility to give a troughing angle of 35 deg. For all the conveyors the number of plies, cover thickness, factor of safety etc. shall be as per the recommendation of belt manufacturer, but not inferior to the figures as tabulated in data sheet. Steel cord belt shall be provided with "Rip Protection" as follows: Bidder shall provide proven experience of Rip protection Belt. Rip protection shall be of Nylon fabric breaker (of weft strength minimum 150kN/m) or steel cord breaker for top and bottom cover. Combination of steel cord for top and Nylon fabric breaker for bottom is also acceptable.
xiv.	**Idlers:** Carrying idlers shall be provided with three equal rolls with troughing angle of 35 deg. and 2 deg. forward tilt (except in case of reversible conveyors). In no case, shall the diameter of the idler roll be less than 152 mm for both carrying side and return side. However, for impact idlers roll the steel diameter shall not be less then 139 mm and rubber thickness shall be minimum 25 mm. Roller used in idlers shall be made from ERW steel tube. Wall thickness shall be minimum 4.0 mm without any negative tolerance. The rollers shall be mounted on EN-8 or equivalent material spindles by means of ball bearings of either deep groove type or seize resistant type (SKF/Equivalent), of 35 mm size for carrying idlers and 25 mm size for return idlers. The bearings shall be adequately sealed and lubricated for life. The rolls shall be supported from fabricated steel brackets. Fixing arrangement of rollers with brackets shall be drop-in type. For adjusting the alignment of the idlers, slotted holes shall be provided in idler supporting base plates. Direction of belt travel shall be clearly marked on the brackets of carrying idlers by embossing / punching. Idler rollers shall be waterproof, dust proof and weather proof against a high velocity water jet. All idlers shall be provided with minimum double labyrinth dust seal. Impact idlers used at the loading and transfer point shall be so designed as to avoid direct loading impact, belt damage and excessive punishment to the carrier. The material used in construction of this type of idlers shall be of resilient type. The return idlers for all conveyors shall be single roll type. For conveyors longer than 400m, two roll return idlers with 10 deg. troughing angle shall be provided. The self-aligning idlers shall be direct acting type, complete with actuating rollers fitted with the ball bearings and mounted inclined towards the belt. The idler frame shall be suitably cradled about a vertical pivot, supported in bearing over a fixed plate. Adequate sealing arrangement shall be provided to prevent contamination of the lubricant by dirt and moisture.
xv.	Belt Cleaners: **External Belt Cleaner:** Spring loaded scraper type cleaner with modular segmented and replaceable polyurethane scrapers blades complete with main cleaner, pre-cleaner (mounted separately) along with accessories and necessary fines (reject of scrapper) chutes shall be provided for all belt conveyors, tripper head pulley and belt feeders at discharge pulleys. The modular units shall be easily replaceable. The scraper assembly shall be easily maintainable from outside without any interference with the chute arrangement and assembly.
xvi.	**Internal Belt Cleaner** V-plough type belt cleaner made of mild steel flats and hard rubber strips with automatic wear adjustment and necessary accessories shall be furnished for cleaning internal surface of the

	conveyor belt.
xvii.	**Belt Take-up Arrangement** Automatic take-up of gravity type shall be generally provided with necessary take-up arrangements complete with bend pulleys, take-up pulley, with its supporting / sliding assembly, wire ropes with turn buckle arrangement (to adjust the level) for suspending the separate take - up weight sliding assembly close to the ground, counter weights and other accessories. Suitable guards marked up scale attached to the frame to monitor belt stretch and access/maintenance platforms with handrails all around etc. shall be provided. Adequate access from conveyor gallery/transfer house/ground etc., as the case may be shall be provided to inspect, repair and maintain the gravity take-up arrangement. Suitable arrangements shall be provided for clearing accumulated Lime from various platforms to ground level. Guides of take up pulley/counter weights shall be sufficiently strong, made up of pipe/box section so that they do not bend during belt snapping. Guide shall be properly supported at regular interval. The prime consideration should be to locate the automatic take-ups at a place where these will work best, in relation to the drive, to keep belt tension at a minimum. Other considerations such as available space, maintenance considerations and the economics of the location should also be taken into account while designing. Take up shall not be located over buildings unless indicated in tender drawings. Height of take-up guide structure shall be sufficient to allow the take-up weight movement up and down for all operating conditions of conveyor and to allow minimum two (2) vulcanizing lengths margin in the belt or percentage of conveyor length (2.5% for synthetic belting or 0.5% for steel cord belting) whichever is larger. Suitable guides shall be provided both for take up pulley and take up weight. Two (2) meter safety fencing along with suitable gate and locking arrangement shall be provided around gravity take-up at the base level / ground level. Irrespective of take-up location, the travel zone of take-up weight shall start from a suitable height above ground level. Suitable buffer arrangement shall be provided to arrest the fall of take-up pulley in order to avoid damage of the pulley assembly in case of belt snapping. Similar buffer arrangement shall be provided for take-up weight also, in case of, take-up weight travel zone terminating above a building floor. Sandpits of 600 mm deep shall be provided at ground below the take-up weights. In case of double stream conveyors, a partition of 3 mm steel plate shall be provided between the two take-up pulleys along entire travel zone of take-up pulleys. Intermediate platforms shall be provided in the take-up zone for maintenance of take - up pulleys / counter weight. Take-up weight shall consist of multi-blocks of RCC/ Cast Iron and not of single block to facilitate adjustment in weight if required during operation. Single heaviest piece shall be suitable for easy handling. Take-up weight block shall be provided with edge protection angle to take care of any damage. Take up weights shall be kept inside a take up weight box frame structure and shall be properly anchored / bolted with the main frame, so that the none of the weight shall be loose/free inside the box. The box shall be painted with counter weight and conveyor number and shall have good aesthetic look.
xviii.	**Pulleys:** Pulleys shall be provided as required for various conveyors. In determination of pulley diameter, no account shall be taken of the pulley lagging. The nominal diameter and face width of the pulleys shall be as stated in applicable international codes. The snub pulleys on each conveyor shall be located to provide a belt wrap on the drive pulleys of not less than 210 deg. wrap is envisaged for single snub drive only. All drive pulley surfaces shall be hot lagged with vulcanised natural rubber lagging grooved in diamond pattern. All non-drive pulleys shall be vulcanised natural rubber lagged (hot) with plain lagging. The rubber to be used for lagging of pulleys shall confirm to specifications listed in data sheet of this section. The rubber lagging of pulleys and method of lagging and testing the same shall conform to applicable international codes. The pulleys shall be made from mild steel conforming to SA/IS:2062 (Tested Quality).

	However, for conveyors with in line magnetic separators, the head end pulleys shall have shell and end disc made of non-magnetic stainless steel material. All the pulleys shall be mounted on the forged steel shafts of EN-8 or equivalent material of adequate proportion by taper lock arrangement, running in heavy duty roller bearings with proper greasing arrangement. The plummer blocks for pulleys shall be of horizontally split type construction with minimum (4) nos. bolts holding the two split halves and with min (4) nos. foundation bolts. The plummer blocks shall be dust tight with double labyrinth seals. Conical head shape nipples conforming to applicable standard suitable drain plug and eye bolt shall be provided. Side covers of plummer blocks shall be heavy duty metallic sheets. No plastic components shall be used. Pulleys shall be mounted on machined & ground surfaces. Suitable guards shall be provided for all tail pulleys and bend pulleys for safety of operating personnel. Suitable stiffening arrangements shall be provided in all pulleys, as required. For selection of pulley shaft dia of all the pulleys, a margin of atleast 20% shall be considered on the maximum tension at designed Conveyor capacity. Selection of pulley diameter, shell thickness, stiffening and shaft diameter shall be subject to approval of Employer during detailed engineering.
xix.	**Belt Protection Equipment:** **1) Pull chord Switch:** Pull chord type (manually reset type) emergency stop switches shall be located on both sides of belt conveyors along the walkways for the entire length of conveyors for emergency stopping of conveyor **2) Belt Sway Switches:** Belt sway switches of self resetting type shall be furnished at periodic intervals to limit belt sway to permissible extent. **3) Zero Speed Switch:** Zero speed switch shall be non-contact (proximity) type electronic switch. Mounting arrangement/ location shall be such that operation, effective sensing distance, sensitivity etc. shall not be effected by accumulation of dust on rotating part or surface of probe.
xx.	Conveyor, Conveyor support, Stringer, Deck plate, Short post shall be considered in the scope of bidder. Galleries will be provided by BHEL based on details from bidder.
H)	**GYPSUM DISCHARGE CHUTE**
i.	The minimum valley angle of chutes shall be 60 degrees at the feeding point to guide the material in the direction of belt travel. Transfer chutes shall be adequately sized and sloped to ensure smooth flow of Gypsum without any accumulation anywhere.
ii.	Chutes shall be made of minimum 20 mm thick TISCRAL / SAILHARD/ LSLAS07 or equivalent material. All chutes should have one inspection door at every floor and for the ones in between the floors (more than 1.5 meter above the operating floor level) suitable access for trouble free maintenance shall be provided. For sealing of inspection doors labyrinth type arrangement to be provided.
iii.	Complete chute work in the region of flap gates shall be fabricated from 20 mm thick TISCRAL or equivalent. In case of vertical chute (valley angle more than 80 degree) complete chute, work shall be of 20 mm thick TISCRAL or equivalent material. While finalizing the chute work inside the building, arrangement for shifting and replacing chute legs, proper handling arrangement/wall openings, trolleys, hoists shall also be provided. While fabricating the chute, no welds in between shall be allowed.
iv.	**CHUTE BLOCKAGE SWITCHES**

a.	One no. chute blockage switch of proven type shall be provided
b.	Chute blockage switch shall trip the feeding conveyor in case of Chute blockage and protect the feeding conveyor equipment.
J)	**GYPSUM INTERMEDIATE SILO**
i.	Gypsum Intermediate silo , its supports and platforms, stairways will be fabricated and supplied by BHEL. However the complete design, GA, manufacturing drawings (excluding Silo supporting structure),Civil Loading details, Silo accessories, Instrumentation, drains are in Bidder's Scope. Silo shall be a steel structure.
ii.	It shall be possible to store and transport Gypsum out of the Gypsum Intermediate Silo at the same time (in a parallel operation situation).
iii.	The penthouse on top of the silo shall be insulated to avoid condensation at the inner walls. Air ventilation in the roof shall ensure the exhaust of vapors.
iv.	Measure shall be taken to avoid any blocking of the silo outlet.
v.	Care and respective measures shall be taken to avoid problems with I&C and electrical equipment inside the silo due to the high dust and humidity atmosphere.
vi.	In the bottom of the intermediate silo, a drainage system shall ensure the collection and discharge of condensation water and water of post-dehydration of Gypsum. This drain water shall be drained to the Gypsum area drain sump.
vii.	The Gypsum intermediate silo shall be equipped with all necessary devices for feeding the pipe conveyors transferring the gypsum to the gypsum handling system at jetty.
viii.	Adequate access by stairways and platforms shall be provided to all instrumentation equipment. Personal and equipment lifting devices shall be provided in the silo.
ix.	Safety of Personnel and plant shall be addressed in the design and the intended operation procedures of the gypsum dewatering system with close attention to guarding, anti-run back, braking and trip systems. Safety requirements for material handling plant according to International standards shall be applied.
x.	Careful consideration shall be given by the bidder to the maintainability of the equipments.
K)	**GYPSUM INTERMEDIATE SILO-BOTTOM EXTRACTION DEVICE**
i.	**Discharge Arm**
a.	The logarithmically shaped discharge arm shall be a fabricated construction and designed as a beam of uniform strength. The combination of configuration and choice of material guarantees minimum wear and high strength.
b.	The discharge arm shall activate the material from underneath the material column under cutting beyond the outlines of the silo wall. This helps avoid accumulations and prevent the bulk material from sticking to the silo wall, funnel flow or bridging.
c.	The arm shall be driven via a single or multiple drive units and a slewing ring bearing located below the silo bottom. The discharge chute forms an integral part of the drive and rotates with the arm. The discharge arm shall be fastened to a pocket inside the rotating chute by a bolted connection.
d.	The tip of the arm shall be hard-faced for wear protection as standard. If necessary, additional protection can be provided depending on the specific application.

e.	The leading face of the discharge arm shall be lined with a wear plate of 10 mm thickness.
ii.	**Pressure Relief Cone with Supports**
a.	The pressure relief cone and the support arms shall be fabricated from mild steel and are designed to take all known structural loads including pressure from the bulk material. An adjustable, segmented slot ring fabricated of mild steel shall be fitted to the underside of the cone for metering the discharge rate of the material.
b.	The dimensions and angles of the cone and support arms shall be designed to suit the bulk material flow characteristics in order to achieve mass flow.
c.	The cone support arms have to be fitted into the silo walls on site by others. The number and size of the support arms shall be determined from structural calculations depending on the silo pressure.
d.	For cones with a diameter greater than 3.0 m, the structure shall be split into smaller sections for ease of transportation. These sections will be be welded together on site by BHEL under the supervision of silo supplier.
iii.	**Discharge Bottom (Silo Bottom)**
a.	The discharge bottom consists of mild steel plates supported from underneath by reinforcement ribs designed to withstand the structural loads including silo pressure.
b.	The undercut with its welded flange serves as a bolted connection for the silo.
c.	The bottom is partially machined to ensure accurate tolerances for the installation of the drive units and the slewing ring bearing.
d.	The bottom comprises the following parts: - Steel fabrication with undercut and reinforcing ribs - Ball bearing slewing ring with external Gearing - Rotating chute - Sealing between rotating chute and fixed bottom fabrication
e.	For bottom diameters above 4.0 m, the structure is split into smaller sections for ease of transportation. These sections have to be welded together on site by BHEL.
f.	Dedusting filters, fans and ducting (if required) shall be in the scope if bidder.
iv.	**Ball Bearing Slewing Ring:**
a.	The slew bearing has to have 100% dust proof sealing arrangement under dynamic condition also.
v.	**Lubrication System**
vi.	A two-circuit lubrication system shall be provided. - 2 grease pumps with electric motors (for lubrication of slewing gear and pinion shafts) - all necessary distribution valves pipe work to the lube points - brackets for fixing the lubrication unit underneath the silo bottom
vii.	**External Electric Drive Units** Located underneath the silo bottom, each drive consisting of: Electric motor, Pinion shaft with bearings and machined supports planetary gear box

viii.	**Electrical equipment:** - 1 proximity switch for arm speed indication, complete with cam wheel, without pulse transducer - Bidder shall provide details of protection of Rotary Extractor in terms safety switches & operation interlocks. - Bidder shall inform if any de-dusting system is required. Bidder to confirm proper Sealing against dust emission.
ix.	Bidder to procure this extraction device from the supplier who has references for the similar application. Reference list for previous installations for similar application shall also be furnished to the employer
I)	**SHUT-OFF GATES & GYPSUM DIVERTER**
i.	Gypsum intermediate silo outlet chute shall be provided for feeding Gypsum from silo to the Pipe conveyor. The size of the opening chute shall be sufficient to ensure proper flow of the Gypsum. The outlet chute shall be provided with suitable poke doors/holes in order to remove jamming/blockage. A motorized bunker shut-off gate shall be provided at the outlet of each silo.
ii.	All parts of the gate in contact with Gypsum shall be of abrasive and corrosion resistant
iii.	The shut-off gates and its actuator shall ensure 100% closing of the gate even with 'bunker full of Gypsum'.
iv.	Facility shall be provided to open/close the bunker outlet gate, through actuator, from remote as well as local.
v.	In addition, a hand wheel with proper access shall also be provided for manual operation of the gate. The force at the rim of the hand wheel shall not exceed 35 kg with bunker full of Gypsum.
vi.	One (01) no. of Gypsum diverter shall be provided at the outlet of each Vacuum Belt Filter. One (01 no of Gypsum diverter shall be provided at the outlet of each Gypsum Intermediate silo. Gypsum Diverter shall be designed such that there is no accumulation of the gypsum on the diverter plate. Material of diverter shall be SUS304 with buffing for your reference. These Gypsum diverters shall be motor driven and shall be controlled from remote and local.
E)	**PIPING**
i.	The slurry pipes shall be sized to minimize erosion and avoid settling of the gypsum at all load operation. The slurry pipes shall be lined with min. 4mm thick chlorobutyl rubber lining. The Bidder to provide slurry pipes of size lower than 3" made up of FRP. All the rubber-lined pipes shall be of flanged connection.
ii.	Belt filter washing pumps shall have a minimum flow line to tank with a restriction orifice to control.
iii.	The valves shall be of proven type and the supplier shall submit a detailed valve schedule for approval.
iv.	Supplier shall provide all necessary arrangements for purging & flushing of all the process pipelines, equipments etc.
v.	All Lube oil , Instrument Air piping shall be made up of Gr.304 Stainless Steel material
	All process water & Cooling water piping shall be made up of Carbon Steel Pressure Piping

vi.	**For details on Pipe schedule kindly refer to Annexure-XIV-Pipe & Valve Schedule**
vii.	**Terminal Point for Piping:** 1) Instrument Air Pipe :50NB All these pipes are provided near to Gypsum Dewatering building. Pipe sizes are tentative and any changes in detail engineering stage shall be borne by the bidder.
M)	**VALVES**
i.	**For details on Valve schedule kindly refer to Annexure-XIV-Pipe & Valve Schedule**
O)	**ACCESSORIES:**
1.	**Expansion Joints:**
i.	Expansion Joints shall be provided at suction and discharge of each pump and also for other equipments wherever applicable.
2.	**Pressure Gauges:**
i.	Pressure Gauges shall be furnished for at suction & discharge of each pump. Pressure gauges of class 1.6 or better must be used wherever applicable in the dewatering system. Pressure instrument for measurement of steady pressure at varying pressure shall operate in a band centered on 60% of its maximum range. Pressure gauges shall have a dial size of 160 mm. Pressure gauges shall be with diaphragm seal for slurry application. Pressure gauges for other medium shall be with gate valves. All the wetted parts shall be SS316 or equivalent.
3.	**Flow Measurement & Control:**
i.	Flow indicator shall be Rotameter type. All wetted parts shall be 316 SS or equivalent. Output signal shall be Contact (SW Form: SPDT) for Vacuum Pump Seal water flow. No such output signal required for flow indicator used in Cake and cloth wash water lines.
ii.	Bearing Cooling water flow switch and sight glass shall be provided to monitor the flow of cooling water (as applicable). The alarm shall be generated whenever the cooling water flow falls below preset value. Bearing cooling water Flow switch shall take the signal to PLC / DCS system.
4.	**System control:**
i.	Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a control cabinet.
ii.	Provisions shall be made for the interface between the local cabinet and the DCS such that the operation of the equipments can be controlled from the control console in the FGD Control room.
iii.	**Alarm Signal:** a) Bearing temperature high

	b) Bearing Cooling water flow Low(As applicable) **Interlock signal:** a) Belt filter wash tank level low Bearing Temperature Transmitter for initiating alarm during when "Bearing temperature high" shall be supplied by Bidder. Bearing temperature transmitter shall be provided with local display also. Bearing Cooling water Flow switch for initiating alarm during when "Cooling water flow Low" shall be supplied by Bidder for each system. In addition, sight glass also shall also be provided to view the cooling water flow. Bearing cooling water Flow switch shall take the signal to PLC / DCS system. Level transmitter in Belt filter wash tank for initiating interlock for Belt filter wash pump stop signal will be supplied by BHEL.
P)	**ELECTRICALS**
1.	For detailed specification on Electricals, kindly refer to Annexure-X-Electrical Specification.

7.0 GENERAL REQUIREMENTS:

S.No	Description
1.	Metric unit system shall be used in the drawings and in any displays on the equipments. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm^2G. For instance, the pressure gauges should have dual unit's indication.
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English.
3.	Any item not included above but necessary for safe and reliable operation of the Gypsum Dewatering System shall also be in the suppliers' scope.
4.	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type.
5.	The equipment and the system as a whole shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
6.	All interconnecting pipes / chutes, pipe supports, motor (other drives) etc. along with necessary valves between primary hydro cyclone, vacuum belt filter, waste water hydro cyclone and wherever required within the system shall be in the scope of the supplier.
7.	The overall vibration level shall be as per ISO 10816. (If not stated otherwise specifically for any equipment).
8.	Suitable drain connections shall be provided.
9.	The complete system and individual equipment shall be suitable for continuous stable operation.
10.	Suppliers shall suitable specify their delivery schedule along with the offer and Standard code specified shall be strictly adhered.

S.No	Description
11.	Supplier shall provide the loading of item and other factors which shall be required for effective civil construction.
12.	**CHUTES:** Minimum clear cross section of chute: 600 mm x 500 mm (inside both ways). Minimum clear cross section of Discharge debris chute: 500mm X 500mm (inside both ways)
13.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities and branch piping to each location. Terminal points for all utilities shall be located at skid edge. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.
14.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load-operating hours whichever is longer.
15.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable International standards.
16.	Unless otherwise specified, flanges shall be in accordance with ANSI B16.5 Class 150.
17.	Nameplate: All equipment shall be provided with name plates indicating the item number and service name. Nameplates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
18.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
19.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
20.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
21.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
22.	Provide double nuts for anchor bolts.
23.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
24.	If the driver/driven equipment train is in the resonance condition or any vibration problems

S.No	Description
	occur, the bidder shall solve the problems in a timely manner.
25.	The bidder shall have full responsibility for vibration control of the equipment train at the site and the unit's satisfactory performance, even if the foundation and drivers are provided by the BHEL.
26.	Bidder to quote for the Initial Spare parts (Mandatory Spares) for system and individual equipment.
27.	Bidder shall provide the mating flanges with the necessary gaskets.
28.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
29.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
30.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
31.	Quality Plan to be submitted along with the offer.
32.	During entire period of the project, the bidders shall strictly follow and adhere to the guidelines for effective Health & Safety Management. Supply of safety gears/PPE for bidder's/bidder's sub vendor personnel deputed at site for Supervision of E&C, PG tests etc. shall be in bidder's scope. Also refer to **Annexure-IX- Health & Safety Management Manual** for complying with requirements whichever is applicable.
33.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
34.	Material of construction for all equipment/components shall subject to BHEL/BIFPCL/BIFPCL's consultant approval during detail engineering. Accordingly, bidder shall consider MOC for all equipment/components as per best engineering practice, global standards and global references.
35.	Bidder to provide sub vendor list and Bidder shall strictly adhere to BHEL/BIFPCL approved vendor list. In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by BIFPCL/BHEL before placing order and bidder shall submit relevant documents as per **Attachment-VI-Sub-Supplier Questionnaire.**
36.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from BIFPCL for all equipments & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the approval of BIFPCL/ BHEL, the same may be replaced with another BIFPCL/BHEL approved sub-vendor only, without any price implications to BHEL.
37.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the BIFPCL/ BIFPCL's

S.No	Description
	consultant and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the customer/customer's consultant along with BHEL.
38.	Minor Chipping i.e. up to 50 mm thk, micro leveling and providing shim plates for erection of equipment / item at site shall be in the scope of bidder.
39.	During detail engineering, bidder to strictly adhere to BHEL/BIFPCL/BIFPCL's consultant drawing formats, document numbering, quality plan & FQP formats.
40.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the VGB guideline RDS-PP (Reference Designation System for Power Plants - KKS system).
41.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/BIFPCL/BIFPCL's consultant during detail engineering.
42.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
43.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/BIFPCL/BIFPCL's consultant should be addressed timely by the bidder.
44.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
45.	Bidder shall submit the signed and stamped copy of all the pages, which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work"

S.No	Description
	b. "Not considered in scope of work"
8.0	**PACKING AND FORWARDING**
1.	Packing shall be as per relevant clause of product packing specification – **Annexure-VII**-PE:TS: 888:100:A001 (Sea worthy packing)-**8.4-Packing of Goods in Wooden crates/cases/Boxes-8.4.2- Cases with Lining-Packing Category IV**
2.	Cardboard containers shall be enclosed in a solid wooden container.
3.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
4.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
5.	Crates and packing material used for shipping will become the property of owner (BIFPCL).
6.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship that will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
7.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment, assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
8.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
9.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows.

S.No	Description
	BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (Pvt) LIMITED **2X660 MW MAITREE SUPER THERMAL POWER PROJECT** **BANGLADESH** **EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA** In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
10.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit, of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
11.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials, no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
12.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of cases in which a complete unit of equipment is packed.
13.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as “Top”, “Do not turn over”, “Care” , “Keep Dry” etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks).
14.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)
15.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing list. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
16.	**The packing slip shall contain the following information: -** Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of pump & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
17.	Prior to transport from manufacturer’s work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces

S.No	Description
	shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
18.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
19.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details, the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10 days of LOI.
20.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
21.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.
9.0	**SUPERVISION OF ERECTION, TESTING AND COMMISSIONING**
1.	The erection of Gypsum Dewatering system (GDS) will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit per GDS for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply.
2.	There will be one visit per GDS and totally, there will be 2 visits for 4 Sets of Gypsum Dewatering Systems. The bidder will be informed well in advance for the visit. Bidder shall include 30 working days per visit in the offer with minimum 2 visits.
3.	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
PERFORMANCE TESTING AT SITE	
1.	Bidder to conduct performance test at site to prove the rated Vacuum Belt Filter capacity and Gypsum cake quality.(Residual Moisture content and Chloride content)
2.	Number of visits shall be Two (2). Bidder to complete the test for all 4 GDS. TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
10.0	**EXCLUSION**
1.	The following work associated with the Gypsum Dewatering System will be done by others: a. Civil foundations

S.No	Description
	b. Walkways, platforms and ladders c. Element handling hoists d. Waste Water hydro cyclone feed tank & pump e. Filtrate water tank & pump f. Belt filter wash tank g. Waste water Tank & Pump h. Gypsum Intermediate Silo
11.0	**INSPECTION AND TESTING**
1.	**Hydro cyclones** visual, dimensional etc.
2.	**Pumps :**
a.	Hydrostatic test for pumps is to be conducted at 150 % of design pressure for duration of 30 minutes, taking into consideration of the fact that actual operating temperature is 60 deg Celsius (maximum).
b.	Impeller and rotor shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).
c.	Vibration levels measured on the non-rotating parts shall not exceed the zone limit “B” as defined in ISO 10816 at steady conditions and shall not exceed the zone limit “C” as defined in ISO 10816 at transient conditions. (as already stated above.)
d.	List of Non-Destructive test over and above the material test are as follows: Casing: Material test, Magnetic particle (MPI), DP and Hydro test as applicable Impeller- DPT and MPI as applicable Shaft- Ultrasonic (UT), DPT and MPI Sleeve- DP and Hardness test/ Manufacturer’s recommendation Mechanical Seal- Manufacturer’s recommendation. Base Plate- Stress relieving of weld. Replaceable Rubber liner- Shore Hardness, Class and Type certificate
e.	Vibration test and Noise level test shall be witnessed at shop. (as already stated above.)
f.	Mechanical running and the performance test shall be conducted for Pump at the Bidder’s works before dispatch or where the test facilities are available.
g.	The Bidder shall conduct performance test for the remaining pump and submit the reports.
3.	**Vacuum Belt Filters:**

S.No	Description
a.	All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.
b.	Filter cloths and belts shall be tested for physical properties as per relevant standard
4.	**General Inspection requirements to be considered are as below:**

1.

S.No	Item	Inspection & Test item	Remarks
1.	Hydrocyclones	Material certificate check	
		Dimensional Inspection	
2.	Pumps	Material certificate check	Shaft & impeller only
		Dimensional inspection	
		Non destructive testing	As per specification
		Hydrostatic test	
		Balancing Test	Static & dynamic
		Performance test	Incl. Noise & Vibration
3.	Motors	Material certificate check	
		Non Destructive Testing	
		Dimensional inspection	
		Balancing Test	Static & dynamic
		Function test	
4.	Vacuum Belt filter (with Accessories)	Material certificate check	
		Dimensional inspection	
		Function test	Short time no load test
5.	Vacuum Receiver	Material certificate check	
		Dimensional inspection	
		Hydrostatic Test	
6.	Belt Filter Vent Fan	Material certificate check	
		Dimensional inspection	
		Performance Test	
7.	Conveyor & Silo Extraction Device	Material certificate check	
		Dimensional inspection	
		Function Test	Short time no load test
8.	Rubber lining Pipe	Dimensional inspection	

S.No	Description			
			Visual Inspection	
			Spark Test	
	9.	Butterfly Valve	Material certificate check	
			Non destructive testing	
			Hydrostatic test	
			Operation test	Motorized valve only
	10.	Control Panel	Insulation Resistance Test	As per IEC
			Dielectric Strength Test	As per IEC
			Function Test	
			Dimensional Inspection	
	11.	Control valve & valves	Material certificate check	
			Hydrostatic test	
			Seat leak test	
			Function test	
			Dimensional Inspection	
	12.	RTD	Material certificate check	
			Performance test	
			Hydrostatic test	
	13.	Shut off valve	Material certificate check	
			Hydrostatic test	
			Seat Leak test	
			Function Test	
			Dimensional Inspection	
	14.	Flow meter	Material certificate check	
			Calibration Test	
			Dimensional Inspection	
			Hydrostatic test	
	15.	Flow Nozzles	Material Certificate check	
			Dimensional Inspection	

S.No	Description
2.	MQP (Manufacturing Quality plan) shall be submitted by the bidder along with the technical offer. Above mentioned item-wise inspection requirement is tentative only and shall be mutually discussed and finalized during detail engineering.
3.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by BHEL / BIFPCL prior to manufacture. Inspection of above mentioned tests by BHEL/ BIFPCL representative at bidder's works is envisaged
4.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/BIFPCL.
5.	A dynamic balancing certificates stating that the rotating assembly has been balanced dynamically shall be sent to BHEL/BIFPCL within one (1) week of the successful completion of balancing.
6.	Vibration levels shall be measured during shop running/performance tests.
7.	For surfaces with rubber lining Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.
8.	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.
9.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
10.	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.
11.	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.
12.	Equipment shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
13.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
14.	BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
15.	Bidder to arrange all calibrated gauges, Instruments during inspection at works and also during performance test at site. All inspection, measuring and test equipment used by Bidder shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by the Owner. Wherever asked specifically, the Bidder shall re-

S.No	Description
	calibrate the measuring/test equipment in the presence of Project Manager/Inspector.
16.	Mechanical running test shall be carried out for Vacuum Belt Filter, Vacuum Pump & Belt Filter wash Pump. Bidder to arrange Motor for the shop test and inspection.
17.	Bidder to also refer **Annexure-VIII** –Clause no. B.0.7 w.r.t "Inspection & Testing" for "Testing during Manufacturing" (clause B.0.7.2), and "Testing at Site" (clause B.0.7.3) (which includes Erection Tests, Commissioning Tests, PG Testing, Reliability Run Test etc.)
12.0	**PAINTING**
1.	For painting requirement, bidder to refer Annexure-XI-Painting Specification
2.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope.
3.	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. Bidder shall submit the painting scheme during detail Engg in line with the specification and shall be subject to approval of BIFPCL/ BIFPCL's Consultant.
13.0	**SPARES,TOOLS & TACKLES**
13.1	**START UP & COMMISSIONING SPARES**
	Start-up & Commissioning Spares shall be part of the main supply of the Gypsum Dewatering System. 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 Commercial Operation Date (COD)/ Issuance of Provisional Acceptance Certificate (PAC) shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipments are energized. These start-up & commissioning spare part list shall not be included in "Initial Spare Parts List". Temporary Strainers for Pumps shall be provided during Pre-Commissioning
13.2	**FINAL SPARE PARTS LIST (RECOMMENDED SPARES)**
	Bidders shall also furnish the **Final Spares Part List** (i.e. recommended spares list) along with the offer. Bidder shall provide a "Final Spare Parts List" which shall comprise of all items of the Initial Spare Parts List as well as other spares required for long term routine/planned and breakdown maintenance. Bidder shall indicate all details for each item of aforesaid Final Spare Parts List, such as Bidder's/ Original equipment manufacturers (OEM's) name and location, drawings, normal delivery period, quantity, life time/ service life, Bidder's/OEM's serial numbers and price labeling according to the plant numbering code etc. The format and content of the final spare parts list shall be agreed in the basic/detailed engineering phase and shall be subject to BIFPCL's approval. Then the final spare parts list shall be submitted by the bidder to the BHEL for approval not later than eighteen (18) months prior to the Scheduled Commercial Operation Date (COD)/ Issuance of Provisional Acceptance Certificate (PAC) of 1st Unit. The bidder shall name OEM/ three (3) vendors with complete address for each of the spare parts. Bidder shall quote for the "Final Spares Part List", however it shall not be considered for L1 evaluation, but these spares items shall remain available for order anytime during the first three (3) years commencing from COD of each unit, at the initial unit prices quoted in the offer as

<table>
<tr><th>S.No</th><th>Description</th></tr>
<tr><td></td><td>adjusted pursuant to the indexation mechanism approved by BIFPCL/BIFPCL's consultant. However, the BHEL/BIFPCL shall have the freedom to decide at its sole discretion to purchase spare parts either from OEM (according to quoted unit price as stated above) or directly from sub-vendors or from any other source.</td></tr>
<tr><td>13.3</td><td>INITIAL SPARE PARTS (MANDATORY SPARES):</td></tr>
<tr><td></td><td>Bidder to quote for below mentioned mandatory spares with break up price.
<table>
<tr><th>S.No</th><th>Equipment</th><th>Quantity</th></tr>
<tr><td>1.0</td><td>Hydro-cyclones (For each type)</td><td></td></tr>
<tr><td></td><td>1. Hydro-cyclone Isolation Valve</td><td>10% of each type</td></tr>
<tr><td></td><td>2. Flexible Hose</td><td>2 Sets</td></tr>
<tr><td>2.0</td><td>Vacuum Belt Filter</td><td></td></tr>
<tr><td></td><td>1. Filter cloth</td><td>2 No's.</td></tr>
<tr><td></td><td>2. Carrying Belt for Filter cloth</td><td>1 No.</td></tr>
<tr><td></td><td>3. Vacuum Box seals</td><td>1 Set</td></tr>
<tr><td></td><td>4. Vacuum Pump Impeller Assembly</td><td>1 No.</td></tr>
<tr><td></td><td>5. Bearing for Vacuum Pump</td><td>1 Set</td></tr>
<tr><td></td><td>6. Shaft Seals for Vacuum Pump</td><td>1 Set</td></tr>
<tr><td>3.0</td><td>Belt Conveyor (Gypsum)</td><td></td></tr>
<tr><td></td><td>1. Idlers</td><td>10% of each type</td></tr>
<tr><td></td><td>2. Coupling</td><td>1 no. each</td></tr>
<tr><td></td><td>3. Belt</td><td>1 no. each</td></tr>
<tr><td>4.0</td><td>415V Motors</td><td></td></tr>
<tr><td></td><td>1. Bearing(DE) of each type</td><td>1 no. of each type</td></tr>
<tr><td></td><td>2. Bearing(NDE) of each type</td><td>1 no. of each type</td></tr>
<tr><td></td><td>3. Cooling fan of motors of each type</td><td>1 no. of each type</td></tr>
<tr><td></td><td>4. Terminal Block</td><td>1 no. of each type</td></tr>
<tr><td>5.0</td><td>Field Instruments</td><td></td></tr>
<tr><td></td><td>1. Flow Indicator</td><td>1 no. of each type</td></tr>
<tr><td></td><td>2. Cake thickness sensor</td><td>1 no. of each type</td></tr>
<tr><td></td><td>3. Pressure Gauge</td><td>1 no. of each type</td></tr>
<tr><td></td><td>4. RTD</td><td>1 no. of each type</td></tr>
</table>
Bidder shall quote for the "Initial Spares Part List", and it will be considered for L1 evaluation. Initial spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years' storage in a dry weatherproof building.
All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan.</td></tr>
</table>

S.No	Description
13.4	**SPECIAL TOOLS & TACKLES:**
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.
14.0	**PERFORMANCE GUARANTEE**
	All performance tests for Gypsum Dewatering system and its equipments shall be carried out in presence of the purchaser and in accordance with any latest international codes/standards. 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Gypsum Dewatering system, equipments and its accessories 2) Bidder shall Guarantee and demonstrate each Vacuum Belt Filter capacity of 12.0 TPH wet gypsum cake with an inlet solid concentration of not more than 45% wt. 3) Bidder shall guarantee and demonstrate that gypsum cake moisture content shall not be more than 10% and chloride content shall not be more than 100ppm. 4) The filter cloth shall be guaranteed for a minimum life of not less than 7000 hrs. 5) The liners in hydro-cyclone shall have a minimum wear life of not less than 7000 hrs. 6) The Bidder shall ensure a design of the equipment to achieve an average target availability of 90%. 7) Scheduled Maintenance (Minor Overhauls): Recommended intervals between maintenance outages shall be >25000 hours operation. 8) Scheduled Maintenance (Major Overhauls): Recommended intervals between maintenance outages shall be >75000 hours operation. 9) Noise level-≤85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 10) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions. 11) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BIFPCL's approval. 12) In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
15.0	**BID EVALUATION CRITERIA FOR POWER CONSUMPTION:**
1.	**POWER GUARANTEE** Bidder to specify the guaranteed power consumption of per Gypsum Dewatering system as

S.No	Description
	well as individual equipment in their offer. The following equipments shall be considered for Guaranteed Power consumption calculation (GPC). a. Belt Filter wash Pump – 1 No. b. Vacuum Belt Filter- 1 No. c. Vacuum Pump -1 No d. Belt Filter Vent Fan- 1 No e. Gypsum Reversible conveyor – 50% of Power consumption of One (1) No. conveyor. f. Gypsum Silo extraction device – 1 No.
2.	**BID EVALUATION CRITERIA FOR POWER CONSUMPTION:** The best of the parameter for auxiliary power consumption quoted by any qualified bidder shall be taken as the base or ceiling value. Adjustment factor for excess power consumption in USD = (GPC-CV) X PL X 2 No. of Units. GPC- Guaranteed Power Consumption quoted by bidder in KW CV- Ceiling Value for Guaranteed Power Consumption in KW PL- Power Loading @ 4060 USD/KW Exchange rate as applicable on price bid opening date will be considered.
16.0	**LIQUIDATED DAMAGES FOR POWER CONSUMPTION**
	If actual Power Consumption during prove out (or) PG Test operating at the duty point exceeds the value guaranteed by the bidder, liquidated damages for shortfall in performance shall be deducted from contract price as per the formula given below Liquidated damage deductible in USD = (GPC-APC) X P X 4 sets of Equipments Where • GPC- Guaranteed Power Consumption quoted by bidder in KW • APC- Actual Power Consumption in KW • P- Penalty @ 4060 USD per KW
17.0	**WARRANTY**
1.	The warranty period shall begin on the date of taking over by BIFPCL or date of issuance of the provisional acceptance certificate for the unit (whichever occurs first) and shall end after twenty-four (24) months. Provided that the successful bidder shall extend the provisions of this warranty to cover all repaired and replacement parts furnished under the warranty obligations hereunder, subject to the warranty period for the same being for a period of 24 months from the date on which replacement or renewal work is completed.

S.No	Description
2.	In case of failure of the equipment to meet the guarantee, BIFPCL/BHEL reserves the right to reject the equipment. However, BIFPCL/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .
18.0	**FIRST FILL OF CONSUMABLES:**
1.	Bidder's scope shall also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to COD including top up requirements at the time of issuance of PAC/declaration of COD. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the BIFPCL/BHEL's approval herein shall be furnished eighteen (18) months prior scheduled COD of the 1st unit. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BIFPCL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
19.0	**TRAINING**
	Successful bidder shall provide comprehensive training for BIFPCL/BIFPCL's Consultant Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Gypsum Dewatering System- Operation & Maintenance, Troubleshooting etc.
20.0	**CONFLICT**
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising BIFPCL in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.
21.0	**DOCUMENTATION**
A	**DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER**
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial evaluation. As a minimum requirement, the following information shall be furnished to fully describe the scope of work and services offered. Duly filled-in Technical Data sheets (Annexure I) and guarantee schedule furnished under Annexure-II.

S.No	Description
	1. PID diagram 2. Performance curve 3. Terminal point details. 4. General Arrangement drawings indicating dimensional data with civil loads and pocket details. 5. Rotor GD^2 (kg-m2) for Vacuum Pump 6. Torque Vs Speed curve 7. VBF Sizing Calculation 8. Calculation of Motor rating, Bearing capacity and selection of coupling for Vacuum Belt Filter and Vacuum Pump. 9. Bill of material along with material and code 10. Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipment. 11. Erection, Operation & Maintenance manual with lubrication schedule 12. Procedure for shop / site performance tests 13. Time schedule for delivery. 14. Quality Assurance Plan. 15. Make of all bought out items. 16. Deviation & clarification list 17. Utility Consumption list. 18. Spares List 19. Hoist / Crane requirement. 20. Reference list of similar projects executed. 21. Sub Supplier questionnaire format (Annexure-VI) 22. List of proposed makes and vendors 23. Training program and schedule for BHEL/BIFPCL's personnel 24. Equipment maintenance schedules 25. Technical Description for Gypsum Dewatering System 26. Piping & Valve list. 27. Instrument List 28. General Arrangement for Gypsum Dewatering system building with all equipments. The above documents are required for proper evaluation purpose and vendors are requested to comply with above in all respect.

S.No	Description
B	**DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT**
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements specified here under. However as minimum the following shall be submitted. 1. Drawing Schedule 2. Plot Plan & Layout 3. Process Flow Diagram 4. Equipment List 5. Utility Consumption 6. Chemical List 7. Duly filled technical datasheet. 8. P &I Diagram 9. Operation & Maintenance Manual 10. Performance Test Procedure & Report 11. Outline Drawing of Equipment 12. Fabrication Drawing of Equipment 13. Warranted Performance curve of Machinery 14. Platform Drawing 15. Line Index 16. Piping Material Specification 17. Piping Arrangement Drawing 18. Piping Support Arrangement Drawing 19. Isometric Drawing 20. Data sheet of Piping Parts 21. Valve Drawing 22. Instrument Schedule List 23. Instrument Function Loop Diagram 24. Interlock and Operation Description 25. Interlock/ Sequence Logic Diagram 26. Instrument Power Supply Diagram 27. Instrument Set Point List 28. Instrument Data Sheet 29. Valve Data Sheet, including On-Off Valve 30. Nozzle Elevation Plan for Level Instrument 31. Specification and Drawing of Instrument 32. Instruction Manual for Instrument 33. Local Control Panel Specification 34. Local Control Panel Drawing 35. Cable Duct/Tray Routing Plan 36. Fabrication Drawing for Cabinet Duct/Tray 37. Plot Plan of Field Instrument 38. Layout of Instrument Wiring 39. Layout of Instrument Air Supply Piping and Signal tubing 40. Hook-up Drawing for Instrument 41. Instrument Connection List

S.No	Description
	42. Instrument Cable Schedule 43. Parts Drawing for Instrument Installation Materials 44. Calculation Sheet for Flow Instrument 45. Motor List 46. Motor Data Sheet 47. Outline drawing of Motor 48. Loading Data 49. Planning Drawing of Building 50. Planning Drawing of Foundation 51. Consumable Parts List 52. Lubricant List 53. Special Tool List 54. Spare Parts List for Erection 55. Spare Parts List for Commissioning 56. Spare Parts List for 2 years of Warranty Period Operation 57. Construction Work Specification 58. Construction Manual List 59. Painting Specification 60. Transportation and Storage Specification 61. Shop Inspection Specification 62. Shop Inspection Report 63. Site Inspection Specification 64. Site Inspection Report 65. Supply Item List for Package Verification at Site 66. Packing List 67. Sub-Vendor List 68. Manufacturing Schedule 69. Progress Report Drawings that are reviewed by the BIFPCL / BIFPCL's Consultant will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. BIFPCL / BIPCL's Consultant reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by BIFPCL must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. In addition, One (1) copy of operation and maintenance manuals shall be translated into "Bangla" and provided as paper copies and in electronic format. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially

S.No	Description
	P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per BIFPCL's requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL.

22.0 ANNEXURES

ANNEXURE-I-TECHNICAL DATA SHEET

Sl. No	Description		Data
1.0	**GENERAL**		
	a. Client	:	BHEL-Ranipet
	b. Project	:	MAITREE (2x 660MW)
	c. Ultimate Customer	:	BIFPCL
	d. Location	:	Khulna, Bangladesh
	e. Service	:	Continuous
	f. Installation	:	Inside the Building
	g. Qty for Unit-1	:	2 sets (1W+1S)
	Qty for Unit-2	:	2 sets (1W+1S)
2.0	**MANUFACTURER DETAILS**		
	a. Model	:	Bidder to provide
	b. Type	:	
3.0	**OPERATING CONDITION**		
	Medium to be handled	:	Gypsum Slurry
4.0	**Technical Data**		
4.1	**PRIMARY HYDRO-CYCLONE**		
	i. Stage	:	Bidder to Provide
	ii. Manufacturer	:	Bidder to Provide
	iii. Number of Hydrocyclone	:	Bidder to Provide
	iv. Diameter of Hydrocyclone	:	Bidder to Provide
	v. Diameter of Vortex Finder	:	Bidder to Provide
	vi. Diameter of Apex Valve	:	Bidder to Provide
	vii. Diameter of Feed Inlet	:	Bidder to Provide
	viii. Design Pressure	:	Bidder to Provide
	ix. Working Pressure	:	Bidder to Provide
	x. Feed Flow rate	:	Bidder to Provide
	xi. Overflow Rate	:	Bidder to Provide
	xii. Underflow Rate	:	Bidder to Provide
	xiii. Mesh of separation (50% Removed)	:	Bidder to Provide
	xiv. Solid content of feed slurry	:	Bidder to Provide
	xv. Solid content in underflow of Hydrocyclones	:	Bidder to Provide
	xvi. Solid content in Overflow of Hydrocyclones	:	Bidder to Provide
	xvii. Type of cyclone	:	Bidder to Provide
	a) Cyclone Dia/Height (mm)	:	Bidder to Provide
	b) Required Liquid Feed Pressure	:	Bidder to Provide
	c) Cyclone Connection Number/Dia. (mm)	:	Bidder to Provide
	d) Feed	:	Bidder to Provide

	e) Overflow		:	Bidder to Provide
	f) Underflow		:	Bidder to Provide
	g) Rf Value (Underflow Slurry (m3/hr/Feed Slurry (m3/hr))		:	Bidder to Provide
	h) Material		:	Bidder to Provide
	i) Shell		:	Bidder to Provide
	j) Internal Structure Part		:	Bidder to Provide
	k) Lining		:	Bidder to Provide
	l) Particle Size Distribution		:	Bidder to Provide
	m) Weight		:	Bidder to Provide
4.2	**VACUUM BELT FILTERS (VBF)**			
	a. Manufacturer		:	Bidder to Provide
	b. Model No.		:	Bidder to Provide
	c. Dimensions (W x L x H) (m x m x m)		:	Bidder to Provide
	d. Cloth Width	m	:	Bidder to Provide
	e. Cloth Length	m	:	Bidder to Provide
	f. No. Working / Stand-by		:	Bidder to Provide
	g. Capacity (Guaranteed) Gypsum (Dry) Gypsum (Slurry)	 Kg/hr m3/kg	: : :	Bidder to Provide
	h. Inlet Flow Volume Solid Concentration	 m3/h %w/w	: : :	Bidder to Provide
	i. Gypsum Flow (Dry)	Kg/hr	:	Bidder to Provide
	j. Moisture Removed	%	:	Bidder to Provide
	k. No. of stages of cake washing / water flow	m3/h	:	Bidder to Provide
	l. No. of stages of cloth washing / water flow	m3/h	:	Bidder to Provide
	m. Design Pressure of Vacuum Chamber		:	Bidder to Provide
	n. Operating Pressure of Vacuum Chamber		:	Bidder to Provide
	o. Material / Thickness	mm	:	Bidder to Provide
	i. Casing		:	Bidder to Provide
	ii. Cloth		:	Bidder to Provide
	iii. Gypsum Discharge Hopper		:	Bidder to Provide
	iv. Vacuum Box		:	Bidder to Provide
	p. Life of Cloth	hrs	:	Bidder to Provide
	q. Type /Material of Carrying Belt		:	Bidder to Provide
	r. Type / Material of Sealing Belt		:	Bidder to Provide
	s. Life of Carrying Belt	hrs		Bidder to Provide
	t. Life of Sealing Belt	hrs		Bidder to Provide
	u. Automatic Cloth Tensioning Mechanism Provided			Yes / No - Bidder to confirm
4.3	**VACUUM RECEIVER TANK**			
a.	No. of Tank for each VBF		:	Bidder to Provide
b.	Capacity (m3)		:	Bidder to Provide

c.	Dimensions (Dia x Height) (mm x mm)	:	Bidder to Provide
d.	Material / Thickness (mm)	:	Bidder to Provide
e.	Lining Material / Thickness mm	:	Bidder to Provide
4.4	**Vacuum Pumps**		
a.	Manufacturer	:	Bidder to Provide
b.	Make/Model		
c.	Type	:	Bidder to Provide
d.	No. of Pumps for each Vacuum Belt Filter	:	Bidder to Provide
e.	Rated Capacity Flow (m3/hr)	:	Bidder to Provide
	Rated Capacity Head (mWCl)	:	Bidder to Provide
	Rated Capacity Power (KW)	:	Bidder to Provide
f.	Power consumption (KW)	:	Bidder to Provide
g.	Pump Speed (rpm)	:	Bidder to Provide
h.	Motor Rating (KW)	:	Bidder to Provide
i.	Motor Speed (rpm)	:	Bidder to Provide
j.	Margins (Flow/Head) (%/%)	:	Bidder to Provide
k.	Operation Pressure	:	Bidder to Provide
l.	Design Pressure	:	Bidder to Provide
m.	Material/Thickness (mm) of	:	Bidder to Provide
	Base/Lining	:	Bidder to Provide
	Casing	:	Bidder to Provide
	Shaft	:	Bidder to Provide
	Impeller	:	Bidder to Provide
n.	Type of seal	:	Bidder to Provide
o.	Sealing Water Flow (m3/hr)	:	Bidder to Provide
p.	Bearing	:	Bidder to Provide
	No. of Bearings	:	Bidder to Provide
	Type Of Bearings	:	Bidder to Provide
q.	Type of coupling	:	Bidder to Provide
r.	Whether silencer provided at outlet	:	Yes/No
4.5	**SLURRY PIPES**	:	
a.	Pipe size (mm)	:	Bidder to Provide
b.	Type of Joints	:	Bidder to Provide
	Pipe to Pipe/Pipe to Fittings		Bidder to Provide
	Fittings		Bidder to Provide
c.	Material / Thickness (mm)of Pipe	:	Bidder to Provide
d.	Material Thickness of lining	:	Bidder to Provide
e.	Estimated Life of liners (hrs.)	:	Bidder to Provide
f.	Slurry Solid concentration (w/w %)	:	Bidder to Provide
g.	Slurry Settling Velocity (m/s)		Bidder to Provide
h.	Pipe Velocity (m/s)		Bidder to Provide
4.6	**BELT FILTER WASH PUMPS**		
a.	No. for each VBF		
b.	No. of stand-by pumps for each VBF		
c.	Make / Model		
d.	Impeller Type		
e.	Material / Thickness (mm) of Impeller and lining		

f.	Casing Type		
g.	Material/Thickness of Casing/Lining		
h.	Rated Flow/Head (m3/hr./mWCI)		
4.7	**WASTE WATER HYDROCYCLONE**		
	i. Stage	:	Bidder to Provide
	ii. Manufacturer	:	Bidder to Provide
	iii. Number of Hydrocyclone	:	Bidder to Provide
	iv. Diameter of Hydrocyclone	:	Bidder to Provide
	v. Diameter of Vortex Finder	:	Bidder to Provide
	vi. Diameter of Apex Valve	:	Bidder to Provide
	vii. Diameter of Feed Inlet	:	Bidder to Provide
	viii. Design Pressure	:	Bidder to Provide
	ix. Working Pressure	:	Bidder to Provide
	x. Feed Flow rate	:	Bidder to Provide
	xi. Overflow Rate	:	Bidder to Provide
	xii. Underflow Rate	:	Bidder to Provide
	xiii. Mesh of separation (50% Removed)	:	Bidder to Provide
	xiv. Solid content of feed slurry	:	Bidder to Provide
	xv. Solid content in underflow of Hydrocyclones	:	Bidder to Provide
	xvi. Solid content in Overflow of Hydrocyclones	:	Bidder to Provide
	xvii. Type of cyclone	:	Bidder to Provide
	a) Cyclone Dia/Height (mm)	:	Bidder to Provide
	b) Required Liquid Feed Pressure	:	Bidder to Provide
	c) Cyclone Connection Number/Dia. (mm)	:	Bidder to Provide
	d) Feed	:	Bidder to Provide
	e) Overflow	:	Bidder to Provide
	f) Underflow	:	Bidder to Provide
	g) Rf Value (Underflow Slurry (m3/hr/Feed Slurry (m3/hr))	:	Bidder to Provide
	h) Material	:	Bidder to Provide
	i) Shell	:	Bidder to Provide
	j) Internal Structure Part	:	Bidder to Provide
	k) Lining	:	Bidder to Provide
	l) Particle Size Distribution	:	Bidder to Provide
	m) Weight	:	Bidder to Provide
4.8	**BELT ACCESSORIES**		
4.6.1	**Bearing**		
a.	Carrying	:	Bidder to Provide
b.	Return	:	Bidder to Provide
4.6.2	**Material**		
a.	Roller	:	Bidder to Provide
b.	Spindle	:	Bidder to Provide
4.6.3	**Pulleys**		
i)	General (for all types of Pulleys)	:	Bidder to Provide

a.	Pulley Shaft Diameter	:	Bidder to Provide
ii)	**Drive Pulleys**		
a.	Lagging	:	Bidder to Provide
b.	Lagging thickness	:	Bidder to Provide
c.	Minimum angle of wrap	:	Bidder to Provide
d.	Maximum out of roundness	:	Bidder to Provide
iii)	**Other Pulleys**		
a.	Lagging	:	Bidder to Provide
b.	Lagging thickness	:	Bidder to Provide
iv)	**Rubber for lagging**		
a.	Type	:	Bidder to Provide
b.	Hardness	:	Bidder to Provide
c.	Elongation	:	Bidder to Provide
d.	Strength	:	Bidder to Provide
e.	Abrasion Loss	:	Bidder to Provide
f.	Specific Gravity	:	Bidder to Provide
g.	Adhesion Strength	:	Bidder to Provide
v)	**Bearings for Pulleys**		
a.	Type	:	Bidder to Provide
b.	Casing	:	Bidder to Provide
c.	Sealing	:	Bidder to Provide
d.	Lubrication	:	Bidder to Provide
e.	Pulley Material	:	Bidder to Provide
f.	Shaft Material	:	Bidder to Provide
4.7	**Chutes and Hoppers**		
a.	Minimum Valley Angle	:	Bidder to Provide
b.	Material :	:	Bidder to Provide
	i) Chute work	:	Bidder to Provide
	ii) Sliding zones & adjacent sides	:	Bidder to Provide
	iii) No striking/ Non sliding zones	:	Bidder to Provide
	iv) Chute with valley angle 80 degree and above	:	Bidder to Provide
	v) In the zone of magnetic field	:	Bidder to Provide
	vi) In the zone of flap gates	:	Bidder to Provide
	vii) Discharge Hoods overhead pulleys	:	Bidder to Provide
c.	Inspection Doors	:	Bidder to Provide
d.	Chute Construction	:	Bidder to Provide
	i) Corners	:	Bidder to Provide
	ii) Joints Bolted	:	Bidder to Provide
	iii) Bolt size	:	Bidder to Provide
	iv) Bolts spacing	:	Bidder to Provide
	v) Fixing Arrangement	:	Bidder to Provide
4.7.1	**Skirt Boards**		
a.	Length	:	Bidder to Provide
b.	Height	:	Bidder to Provide
c.	Width Side plate	:	Bidder to Provide

	Top cover		
4.8	**Silo Shut off Gate**		
a.	Type	:	Bidder to Provide
b.	Travel	:	Bidder to Provide
c.	Automatic operation	:	Bidder to Provide
	i) Drive	:	Bidder to Provide
	ii) Minimum Actuator Rating	:	Bidder to Provide
	iii) No. of Operation / Hr.	:	Bidder to Provide
	iv) Protection	:	Bidder to Provide
d.	Manual Operation	:	Bidder to Provide
	i) Maximum effort	:	Bidder to Provide
	ii) Minimum Hand wheel Diameter	:	Bidder to Provide
e.	Flap gate shaft	:	Bidder to Provide
	i) Diameter minimum	:	Bidder to Provide
	ii) Material	:	Bidder to Provide
4.9	**Waste Water Hydrocyclone**	:	Bidder to Provide
	i) Stage	:	Bidder to Provide
	ii) Manufacturer	:	Bidder to Provide
	iii) Number of Hydrocyclone	:	Bidder to Provide
	iv) Diameter of Hydrocyclone	:	Bidder to Provide
	v) Diameter of Vortex Finder	:	Bidder to Provide
	vi) Diameter of Apex Valve	:	Bidder to Provide
	vii) Diameter of Feed Inlet	:	Bidder to Provide
	viii) Design Pressure	:	Bidder to Provide
	ix) Working Pressure	:	Bidder to Provide
	x) Feed Flow rate	:	Bidder to Provide
	xi) Overflow Rate	:	Bidder to Provide
	xii) Underflow Rate	:	Bidder to Provide
	xiii) Mesh of separation (50% Removed)	:	Bidder to Provide
	xiv) Solid content of feed slurry	:	Bidder to Provide
	xv) Solid content in underflow of Hydrocyclones	:	Bidder to Provide
	xvi) Solid content in Overflow of Hydrocyclones	:	Bidder to Provide
	xvii) Type of cyclone	:	Bidder to Provide
	a. Cyclone Dia/Height (mm)	:	Bidder to Provide
	b. Required Liquid Feed Pressure	:	Bidder to Provide
	c. Cyclone Connection Number/Dia. (mm)	:	Bidder to Provide
	d. Feed	:	Bidder to Provide
	e. Overflow	:	Bidder to Provide
	f. Underflow	:	Bidder to Provide
	g. Rf Value (Underflow Slurry (m3/hr/Feed Slurry (m3/hr))	:	Bidder to Provide
	h. Material	:	Bidder to Provide
	i. Shell	:	Bidder to Provide
	j. Internal Structure Part	:	Bidder to Provide

	k. Lining	:	Bidder to Provide
	l. Particle Size Distribution	:	Bidder to Provide
	m. Weight	:	Bidder to Provide

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ANNEXURE II- SCHEDULE OF GUARANTEES

Sl. No	Description			Data
1.	Rated capacity of Vacuum Belt Filter	TPH	:	Bidder to Provide
2.	Guaranteed power consumption of Gypsum Dewatering System at rated capacity	kW	:	Bidder to Provide
3.	Guaranteed a) Gypsum cake moisture content b) Gypsum cake chloride content	 % ppm		Bidder to Provide
4.	Guaranteed life of filter cloth	hrs		Bidder to Provide
5.	Guaranteed life of liners in hydro cyclone	hrs		Bidder to Provide
6.	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor	dB(A)	:	
7.	Maximum vibration (peak to peak amplitude at site)	microns	:	1) For vacuum pump & Belt Filter Wash Pump:
8.	Equipment Availability	%	:	90%
9.	Scheduled Maintenance (Minor Overhauls): Recommended intervals between maintenance outages	hours	:	>25000 hours operation.
10.	Scheduled Maintenance (Major Overhauls): Recommended intervals between maintenance outages shall be	hours	:	>75000 hours operation.

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ANNEXURE – III

REFERENCE LIST as per format shown below. (Atleast two reference plant details)

S.No	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limestone Based FGD Yes/No	Model	Capacity of Vacuum belt filter TPH	Year of Commg	Qty
1.							
2.							

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ANNEXURE – IV- LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

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ANNEXURE -V

A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	No of copies With proposal
1.	Enquiry Specification (signed)	1
2.	Price Sheet	1
3.	Anchor Plan & Civil foundation Loading details	1
4.	Data Sheet	1
5.	Performance curve	1
6.	P & I Diagram	
7.	Terminal point details.	
8.	Proforma Packing List	1
9.	Shortest Manufacturing Time	1
10.	Approximate weight of each skid	1
11.	Required Electric power & other Utility List	1
12.	Deviation List	1
13.	General Assembly Drawing indicating dimension and civil loading details	1
14.	Gypsum dewatering building GA	1
15.	VBF Sizing Calculation	1
16.	Cross-sectional Drawing	1
17.	Scope of Supply	1
18.	Spare List (Recommended)	1
19.	Start-up & Commissioning Spares	1
20.	List of Special Tools	1
21.	Test Arrangement & Test procedure	1
22.	Rotor GD^2 (kg-m2)	
23.	T-S curve	1
24.	Hoist/Crane requirement	1
25.	Catalogue	1
26.	Calculation of Motor rating, Bearing capacity and selection of coupling	1
27.	Bill of material along with material and code	1
28.	Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipment.	1

29.	Erection, Operation & Maintenance manual with lubrication schedule	1
30.	Procedure for shop / site performance tests	1
31.	Time schedule for delivery.	1
32.	Quality Assurance Plan.	1
33.	Make of all bought out items.	1
34.	Deviation list	1
35.	Spares list.	1
36.	Hoist / Crane requirement.	1
37.	Reference list of similar projects executed.	1
38.	List of proposed makes and vendors	1
39.	Training program and schedule for BHEL/NTPC personnel	1
40.	Equipment maintenance schedules	1

B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	No of copies After award of contract	Delivery Time
1.	Utility Consumption	1	2 weeks after contract
2.	Foundation Data including Anchor plan	1	2 weeks after contract
3.	Performance curve	2	2 weeks after contract
4.	Assembly drawings of each equipment	1	1 month after contract
5.	Cross section detail drawing	1	1 month after contract
6.	Data Sheet	1	2 weeks after contract
7.	Lubricating oil list	1	2 months after contract
8.	Special tools list	1	2 months after contract
9.	Piping & Valve drawings	1	2 months after contract
10.	Instrument drawings	1	2 months after contract
11.	Local Control panel drawings	1	2 months after contract
12.	Installation and assembly procedure	1	4 months after contract
13.	Inspection and Test Procedure	1	1 month after contract
14.	Inspection & Test record	1	In 2 weeks after test
15.	Inspection Certificate	1	In 2 weeks after test

Sl. No.	Description	No of copies After award of contract	Delivery Time
16.	Sub vendors List	1	2 weeks after contract
17.	Manufacturing Schedule	1	2 weeks after contract
18.	Progress report	1	Every month
19.	Proforma Packing List	1	2 months prior to shipping
20.	Approximate weight of each skid	1	2 months after contract
21.	Required Electric power	2	2 weeks after contract
22.	Pump and Motor Sizing Calculation	1	2 weeks after contract
23.	Material Test Certificates	2	In 2 weeks after test
24.	Pre Commissioning Check List	2	4 months after contract
25.	Scope of Supply	2	2 weeks after contract
26.	Quality Plan	4	1 month after contract
27.	Operation and Maintenance Manual	• 10 hardcopies and 5 electronic copies in English • 1 hardcopy and 1 electronic copy in “Bangla”	4 months after contract
28.	Spare List (Mandatory, Recommended)	1	1 month after contract
29.	Start-up & Commissioning Spares	2	1 month after contract
30.	List of Special Tools	1	1 month after contract
31.	Delivery Schedule	1	2 weeks after contract
32.	Test Arrangement & Test procedure	2	1 month after contract
33.	T-S curve	2	2 weeks after contract
34.	P & I Diagram	2	2 weeks after contract
35.	Catalogue	2	2 weeks after contract
36.	Gypsum Dewatering Building GA	1	1 month after contract
37.	Motor Data	1	1 month after contract
38.	Recommended repair procedure etc.	1	1 month after contract
39.	Any unique installation instructions shall be noted on the submitted drawings or be provided as a separate document prior to the submission of the Operation and Maintenance Manual	1	1 month after contract

Sl. No.	Description	No of copies After award of contract	Delivery Time
40.	Erection schedule and component list.	1	1 month after contract

Any schedule for other documents mentioned as per Clause: No 21.0 shall be mutually discussed and agreed upon.

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ANNEXURE –VI

FICHTNER'S SUB SUPPLIER QUESTIONNAIRE FORMAT

REFER FICHTNER'S SUB SUPPLIER QUESTIONNAIRE FORMAT - kindly fill the form and furnish the relevant documents to obtain vendor approval from BIFPCL. /BIFPCL's consultant along with the offer.

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ANNEXURE-VII

TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING

Refer to Specification No: PE-TS-888-100-A001 for detailed specification on Seaworthy packing.

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ANNEXURE-VIII

INSPECTION & TESTING

Refer to all clauses for Inspection & testing requirements.

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ANNEXURE-IX

HEALTH & SAFETY MANAGEMENT MANUAL

Refer to all clauses for Health & Safety requirements.

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ANNEXURE –X- ELECTRICALS SPECIFICATION

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ANNEXURE – XI- PAINTING SPECIFICATION

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ANNEXURE – XII- PROCESS FLOW DIAGRAM OF GYPSUM DEWATERING SYSTEM

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ANNEXURE – XIII- GA DRAWING OF GYPSUM DEWATERING BUILDING (Typical)

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ANNEXURE – XIV- PIPE & VALVE SCHEDULE

SIGNATURE OF BIDDER ----------

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