
TECHNICAL SPECIFICATION

FOR

GYPHUM DEWATERING SYSTEM

CONFIDENTIAL

CUSTOMER : NTPC
PROJECT : DADRI 2 x 490MW
APPLICATION : FLUE GAS DESULPHURIZATION SYSTEM



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



TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS

DADRI:FGD:GDS:R01

TECHNICAL SPECIFICATION FOR GYPSUM DEWATERING SYSTEM

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NTPC DADRI 2X490MW TPS**

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Revision	Date	Status and Description	
01	10.05.2018	Revised Issue	Following changes incorporated a) Cl. No. 25 (O & M Services for 10 Years Operation) added b) Valve material specification (Doc. No. Dadri:Valve:001) added
00	04.04.2018	Fresh Issue	General technical specifications



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24.9	ATTACHMENT 3K - QUALIFICATION OF GYPSUM DEWATERING SYSTEM SUPPLIER
PART - II	
TEN YEARS - AMC and O&M SPARES	
25	O & M Services for 10 Years Operation – Annual Maintenance Contract (AMC).



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PART –I

MAIN SUPPLY



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1.0 PROJECT INFORMATION:

a.	Owner	NTPC
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization system

A) SITE CONDITIONS

1.	Ambient Temperature and Relative Humidity		
a.	Average Site Condition ASC		
	Ambient Temperature	:	27 deg C
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

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.

B) PROJECT LOCATION AND APPROACH

a.	Country	India
b.	State/Division	Uttar Pradesh
c.	District	Gautam Buddha Nagar

2.0 APPLICABLE CODES & REGULATIONS

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Gypsum Dewatering System shall follow the latest applicable Indian/International (AISI/ASME/EN/Japanese) Standards.

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, supervision of erection & commissioning and performance guarantee testing, 10 year AMC of Gypsum Dewatering system (GDS) along with accessories for the Flue Gas Desulphurization plant of DADRI 2 x 490 MW TPS. The following points may be noted.

- a. There are 2 units of each 490 MW and each unit is envisaged with one FGD system. The FGD system will be provided with common gypsum dewatering system for both FGD units. Common gypsum dewatering system consists of two (2 x100%) streams i.e. 1 working + 1 standby. Gypsum dewatering system will be installed in Gypsum Dewatering Building. Each stream of gypsum dewatering system shall consist of following as a minimum requirement
 - i. One set of primary hydro cyclones



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- ii. One vacuum belt filter and accessories
 - iii. One no. vacuum receiver
 - iv. One no. vacuum pump with motor
 - v. One set of Secondary Hydro-cyclones
 - vi. 2 nos. (1W+1S) Belt filter cloth wash pump with motor
 - vii. 2 nos. (1W+1S) cake wash pump with motor
 - viii. Complete piping and valves of the system.
- 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. 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**)".
- d. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall be considered as null and void.
- e. No deviation or exception shall be permitted without the written approval of the purchaser.
- f. 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.
- g. 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.
- h. 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 Bidder shall offer only proven design which meets the Provenness criteria indicated in the Annexure-I. Necessary document evidences as per Attachment-3K for qualification shall be submitted along with the bid. If bidder doesn't meet the specified Provenness criteria, they are denied to participate in this tender.

The Bidders are required to meet the Qualification Requirement (QR) for Gypsum Dewatering System as per **Annexure-I & submit the Annexure to qualification requirement (Attachment-3K)**



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5.0 TECHNICAL INFORMATION

S. No.	Description	Requirement
1.	Quantity	
	Quantity of Gypsum dewatering system	2 streams (1 working + 1 standby)
2.	Parameters	
	Vacuum belt filter design capacity	32.10 TPH (wet cake) each
	Duty	Continuous
	Location	Inside Building

5.1 GYPSUM DE-WATERING SYSTEM: -PROCESS DESCRIPTION

A common gypsum dewatering system for both FGD units is envisaged. Gypsum slurry is produced in the FGD plant. Two stage gypsum dewatering system, consisting of a primary stage of sets of hydro-cyclones and secondary stage of vacuum belt filters for dewatering of gypsum slurry from FGD plant up to less than 10% moisture is envisaged.

Gypsum slurry produced by FGD plant is collected in primary hydro cyclone feed tank. Primary hydro cyclone feed pump (**BHEL scope**) supplies gypsum slurry to Primary Dewatering Hydro-cyclones.

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 moisture content less than 10%.

The overflow from the primary set of hydro-cyclone shall be taken to a secondary hydro-cyclone feed tank (**BHEL Scope**). Secondary Hydro cyclone feed pumps (**BHEL Scope**) shall transfer the slurry from tanks to Secondary hydro cyclone feed.

Water from vacuum receiver tank and the underflow from the secondary hydro-cyclone shall be taken to the filtrate water tank (**BHEL Scope**). The over flow from the Secondary hydro-cyclone shall be taken to a waste water tank (**BHEL Scope**)

For cake washing only clarified water shall be used. For this purpose, 2x100% cake washing pumps shall be provided for each Vacuum Belt Filter. One stage of cloth washing arrangement shall be provided along with 2x100% cloth washing pumps for each Vacuum Belt Filter. Cake wash tank & cloth wash tank are **in BHEL scope**.



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5.2 PROCESS WATER ANALYSIS FOR CLOTH WASH

Process water is envisaged for belt filter cloth wash.

S.No	Constituents	Unit	Water quality
1.	Total Dissolved Solids	ppm	~2110
2.	Calcium as CaCO ₃	ppm	721
3.	Magnesium as CaCO ₃	ppm	286
4.	Sodium as CaCO ₃	ppm	358
5.	Potassium as CaCO ₃	ppm	
6.	Iron as Fe	ppm	1.7
7.	Fluoride as F	ppm	0.11
8.	Bicarbonate as CaCO ₃	ppm	688
9.	Chlorides as CaCO ₃	ppm	168
10.	Sulphate as CaCO ₃	ppm	512
11.	Nitrate as NO ₃	ppm	0.55
12.	Silica	ppm	121
13.	pH		7.0 – 8.2
14.	Turbidity	NTU	55

5.2 CLARIFIED WATER ANALYSIS FOR CAKE WASH

Clarified water is envisaged for cake wash.

S.No	Constituents	Unit	Water quality
1.	Total Dissolved Solids	ppm	~390
2.	Calcium as CaCO ₃	ppm	131
3.	Magnesium as CaCO ₃	ppm	52
4.	Sodium as CaCO ₃	ppm	65
5.	Potassium as CaCO ₃	ppm	
6.	Iron as Fe	ppm	0.3
7.	Fluoride as F	ppm	0.02
8.	Bicarbonate as CaCO ₃	ppm	125
9.	Chlorides as CaCO ₃	ppm	31
10.	Sulphate as CaCO ₃	ppm	93
11.	Nitrate as NO ₃	ppm	0.1
12.	Silica as SiO ₂	ppm	22
13.	pH		7.0 – 8.2
14.	Turbidity	NTU	10



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6.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, Engineering, Manufacturing, Packing, Supply, Supervision of Erection & Commissioning, Performance Guarantee Test, handing over of the system to final Customer (NTPC).

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

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.

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

The scope of supply for **Gypsum Dewatering System** shall include but not limited to the following:

Sl n	Item Description	Qty
1.	Primary hydro cyclone	2 set
2.	Vacuum Belt Filter with driving motor (VFD), VFD panel and accessories	2 set
3.	Gypsum Discharge chute	2 set
4.	Vacuum receivers	2 set
5.	Vacuum pumps with driver	2 set
6.	Secondary Hydro-cyclones	2 set
7.	Vent fan and its arrangement	2 set
8.	Complete interconnecting piping system	1 lot
9.	Cake wash pumps with motor	4 no's
10.	Cloth wash pumps with motor	4 no's
11.	Complete set of arrangement for cloth and cake washing including spray nozzles, etc.	2 set
12.	Companion flanges with gaskets and fasteners	1 lot
13.	Coupling with guards	1 lot
14.	One complete set of instruments required for the GDS	1 lot
15.	Local control panel	1 lot
16.	Cabling and wiring from local instrument to JB	1 lot
17.	Foundation bolts	1 lot
18.	Factory test	1 lot
19.	Supervision of erection / commissioning	1 set



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20.	Start-up & Commissioning spares	1 set
21.	Special tools & Tackles if applicable	1 set
22.	Painting and Rust Prevention during shipment and construction	1 set
23.	Seaworthy Packing & Forwarding to Project Site office	1 set



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6.1 DESIGN / PROCESS PARAMETERS:

6.1.1 Design Conditions of Primary Hydro cyclones:

Sl.no	Description	Requirement
1.	Number of Hydro cyclone	2 sets (1 Working+1 Standby)
2.	Design Capacity	115 m ³ /hr each
3.	Operating capacity	102.1 m ³ /hr each
4.	Type of hydro cyclone	Vertical
5.	Material (MOC) of Cyclone Clusters	Polyurethane or urethane
6.	MOC of Feed chamber	CS+12 mm rubber lining
7.	MOC of overflow chamber	CS+12mm rubber lining
8.	MOC of under flow chamber	CS+12mm rubber lining

6.1.2 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.)	102.1	59.0 *1)	43.1 *1)
2.	Total Flow (t/hr.)	124.0	65.5 *1)	58.5 *1)
3.	Temp(deg C)	61.3	61.3	61.3
4.	Slurry conc. (wt. %)	30	16.6 *1)	>45 *2)
5.	Density (Kg/m ³)	1215	1111 *1)	1356 *1)
6.	Solid Composition (wt.%)			
	CaSO ₄ .2H ₂ O	90.0	90.0	90.0
	CaCO ₃	3.6	3.6	3.6
	Fly Ash	0.8	0.8	0.8
	Other	5.6	5.6	5.6
	Total	100	100	100
7.	pH	4-7	4-7	4-7
8.	Cl ⁻ (mg/l)	20,000	20,000	20,000

*1) shall be finalized by vendor

*2) Shall be guaranteed by vendor



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6.1.3 Design Conditions of Secondary Hydro cyclones:

Sl.no	Description	Requirement
1.	Number of Hydro cyclone	2 sets (1 Working+1 Standby)
2.	Design Capacity	60 m3/hr each
3.	Operating capacity	59 m3/hr each
4.	Type of hydro cyclone	Vertical
5.	Material (MOC) of Cyclone Clusters	Polyurethane or urethane
6.	MOC of Feed chamber	CS+12mm rubber lining
7.	MOC of overflow chamber	CS+12mm rubber lining
8.	MOC of under flow chamber	CS+12mm rubber lining

6.1.4 PROCESS PARAMETERS- @ OPERATING POINT -SECONDARY HYDROCYCLONES

Sl No	Parameters	Secondary Hydro cyclone – Feed Slurry	Secondary Hydro cyclone– Overflow	Secondary Hydro cyclone – Under flow
1.	Total flow (m3/hr)	59.0 *1)	36.9*1)	22.1*1)
2.	Total flow (t/hr)	65.5 *1)	37.7*1)	27.8*1)
3.	Temp (° C)	61.3	61.3	61.3
4.	Slurry conc. (wt. %)	16.6 *1)	< 3 *2)	35 *1)
5.	Density (kg/m3)	1111*1)	1022*1)	1259 *1)
6.	pH	4-7	4-7	4-7
7.	Cl- (mg/l)	20,000	20,000	20,000

*1) shall be finalized by vendor

*2) Shall be guaranteed by vendor



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6.1.5 Design Conditions of Vacuum Belt Filter:

Sl.no	Description	Requirement
1.	Number of vacuum belt filters	2 sets (1 Working+1 Standby)
2.	Design Capacity	32.10 TPH (wet cake) each
3.	Operating capacity	29.10 TPH (wet cake) each
4.	Inlet solid concentration	Not more than 45%
5.	Outlet gypsum cake moisture content	<10%
6.	Outlet gypsum cake chloride content	<100 ppm

6.1.6 PROCESS PARAMETERS- @ OPERATING POINT - VACUUM BELT FILTER:

S.No	Parameters	Belt Filter Feed Slurry	Product Gypsum	Filtrate	Washing Water *
1.	Total Flow (m ³ /hr)	43.1 *1)			
2.	Total Flow (t/hr)-Wet	58.5 *1)	29.10		
3.	Temp(deg C)	61.3			
4.	Solid conc. (% wt)	Max 45	> 90 *2)	<0.2	
5.	Slurry density (kg/m3)	1356 *1)			
6.	Solid Composition CaSO ₄ .2H ₂ O CaCO ₃ Fly Ash Other Total	90.0 3.6 0.8 5.6 100	-		
7.	pH	4-7	5~8		
8.	Cl ⁻	20,000 ppm	<100 ppm *2)		

*1) shall be finalized by vendor

*2) Shall be guaranteed by vendor

Belt filter and the peripherals shall be designed at 32.1 TPH (wet) discharge of product gypsum

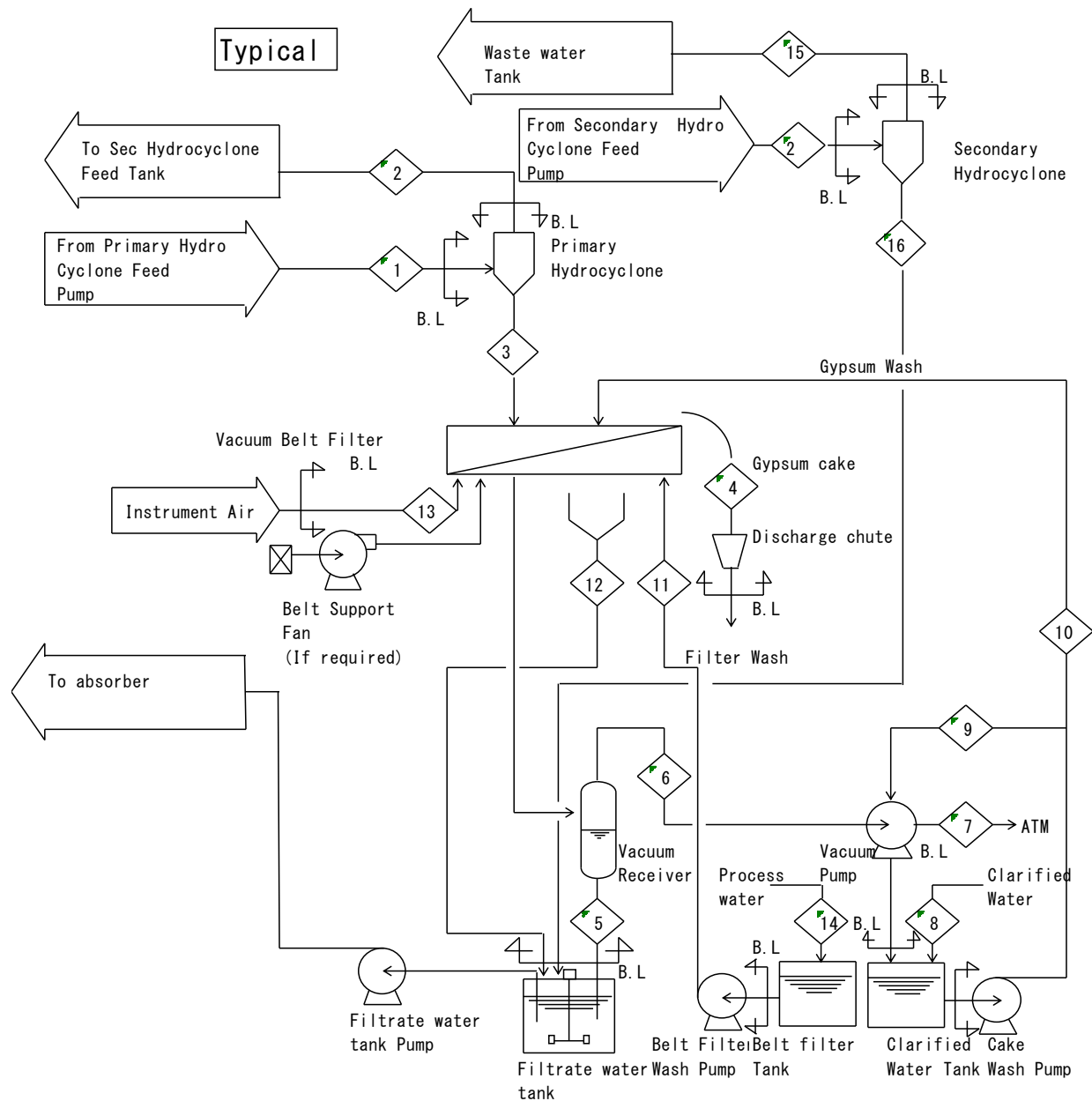
- a. ***Quantity of water shall be finalized by the vendor.**
- b. ***Property of process & Clarified water is as below.**



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6.1.7 PROCESS FLOW DIAGRAM WITH SCOPE DEMARCATON





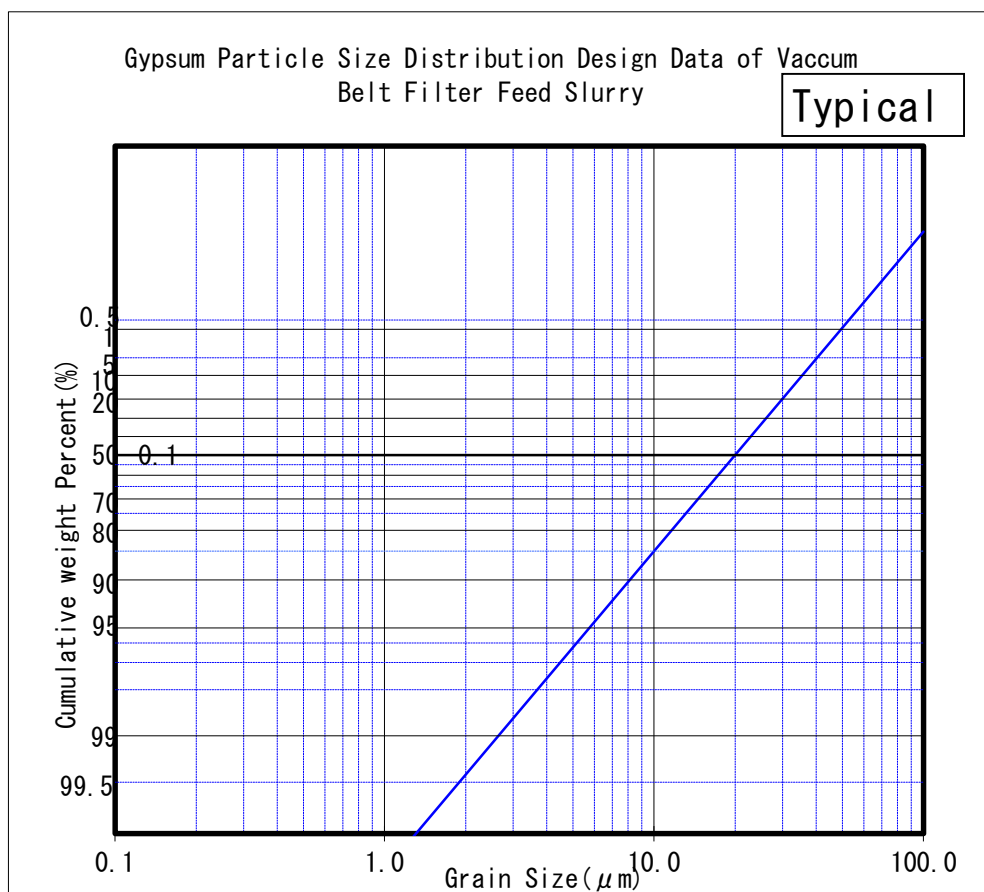
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6.1.8 TERMINAL POINTS

1. Primary hydro cyclone feed slurry will be provided by BHEL at the inlet flange of Primary hydro cyclone.
2. Primary hydro cyclone overflow shall be terminated by bidder at overflow outlet flange.
3. Secondary hydro cyclone feed slurry will be provided by BHEL at the inlet flange of secondary hydro cyclone
4. Secondary hydro cyclone overflow shall be terminated by bidder at overflow outlet flange.
5. Filtrate water from vacuum belt filter, wash water after belt filter cloth/cake washing and secondary hydro cyclone underflow shall be terminated by bidder in filtrate water tank.
6. Service & instrument air will be provided at one location near plant boundary. Further piping from terminal point to GDS system utilities are in bidder's scope.
7. Discharge of gypsum through discharge chute onto the gypsum belt conveyer is in bidder's scope. Please refer enclosed typical layout & elevation drawing of GDS.

6.1.9 Gypsum particle size distribution of Belt Filter Feed slurry





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7.0 GENERAL REQUIREMENTS:

S.No	Description
1.	All interconnecting pipes / chutes, pipe supports, trestles, valves, motor (other drives) etc. along with necessary valves between primary hydro cyclone, vacuum belt filter, secondary hydro cyclone and wherever required within the system shall be in the scope of the supplier. Please refer scope demarcation drawing under clause no. 6.1.7
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.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5.	Noise level produced by any equipment individually or collectively shall not exceed 85 dB 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 GDS drive assemblies shall be submitted as part of the proposal data.
6.	The overall vibration level shall be as per ISO 10816.
7.	Suitable drain connections shall be provided.
8.	The equipment shall be suitable for stable operation continuously.
9.	Suppliers shall suitable specify their delivery schedule along with the offer and Standard code specified shall be strictly adhered.
10.	All instruments as per enclosed P&ID and any other instrument required for smooth function of Gypsum dewatering system wherever necessary shall be supplied by the bidder
11.	Supplier shall provide the loading details of equipment and other factors which shall be required for civil construction.
12.	CHUTES: Minimum clear cross section of Discharge chute: approx. 600 mm x 500 mm .
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 GDS and branch piping to each nozzle. Terminal points for all utilities shall be located at single point. The



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S.No	Description
	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 Indian / International standard.
16.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
17.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates 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 minimum 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 occur, the bidder shall solve the problems in a timely manner.
25.	Bidder shall provide the mating flanges with the necessary gaskets.
26.	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.
27.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.



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28.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
29.	Quality Plan to be submitted along with the offer.
30.	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.
31.	Material of construction for all equipment/components shall be subject to NTPC/ BHEL approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.
32.	Bidder to provide sub vendor list and Bidder shall strictly adhere to NTPC 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 NTPC/ BHEL before placing order and bidder shall submit relevant documents.
33.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from BHEL / NTPC 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 NTPC/ BHEL, the same may be replaced with another NTPC/BHEL approved sub-vendor only, without any price implications to BHEL.
34.	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 NTPC/ 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



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S.No	Description
	f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the NTPC along with BHEL.
35.	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.
36.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats, document numbering, quality plan & FQP formats
37.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with reference Designation System for Power Plants - KKS system.
38.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
39.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
40.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/NTPC should be addressed timely by the bidder.
41.	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 (NTPC) shall also be in the scope of the bidder.
42.	Bidder shall submit the signed and stamped copy of all the pages of this technical enquiry specification signed by authorized signatory to confirm that all clauses are read and accepted by the bidder without deviation and considered in their scope work except the deviations declared in the deviation schedule.
8.0	DESIGN AND CONSTRUCTION
8.1	PRIMARY HYDRO CYCLONE
a.	Each set of primary hydro-cyclone shall be provided with 10% spare hydro-cyclones.
b.	The primary hydro-cyclone shall be installed above the belt filters.
c.	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. Individual isolation valve shall be provided for each hydro-cyclone for this purpose.
d.	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.



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S.No	Description
8.2	VACUUM BELT FILTERS
a.	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.
b.	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.
c.	In case, the contractor 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.
d.	The vacuum box shall ensure tight sealing with the belt/cloth and shall be of proven design.
e.	The belt filter shall have an automatic cloth tracking mechanism and shall be provided with all required instrumentation as per the supplier's proven practice. The belt filter shall have an automatic cloth tensioning mechanism.
f.	The filter shall be provided with minimum 2 stages of cake washing for removing impurities in the gypsum. For cake washing only clarified water shall be used. For this purpose, 2x100% cake washing pumps for each Vacuum Belt Filter. One stage of cloth washing arrangement shall also be provided along with 2x100% cloth washing pumps for each Vacuum Belt Filter.
g.	The filtrate from gypsum slurry and from cake 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.
h.	Gypsum cake from each belt filter shall be discharged through a hopper onto belt conveyor being provided by the Employer.
i.	Local control panel shall have display on the front panel and necessary electrical parts.
j.	The service factor of the gear unit (if any) shall be minimum 1.5.
k.	Piping and wiring within the skid should be in the vendor's scope.
l.	Nozzles and connections The suction and discharge pipes will be flanged and will have the same nominal test procedure as the body of the pump. Threaded connections are not admitted in these pipes.
m.	The flanges shall comply with the following standards: - Steel flanges as per ANSI B16.5 (raised face type, at least class 150)



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S.No	Description
	- Cast iron flanges as per ANSI 16.1 (flat face type, at least class 125) - The pipe shall be designed according to API676 with regards to the force.
8.3	VACUUM SYSTEM
a.	The filtrate from each belt filter, cake washing & cloth washing shall be taken to receiver tank(s) as per the supplier's proven practice.
b.	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.
8.3.1	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 cavitations under all operating conditions. The seals shall be of proven design.
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.	Pump Casing Pumps shall be Radial Split Casing, Close/Semi-open, Over-hang, End Suction type Back Pull-out design, Vertical Discharge type for Horizontal Centrifugal Pump. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature. Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.
f.	Impeller Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled. The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.
g.	Impeller/Casing Wearing Rings



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S.No	Description
	Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.
h.	Shaft The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.
i.	Shaft Sleeves Renewable type fine finished shaft sleeves shall be provided at mechanical seals. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.
j.	Bearings Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished. The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.
k.	Mechanical Seals
i.	Mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.
ii.	The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.
l.	Pump Shaft Motor Shaft Coupling



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S.No	Description
	The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.
m.	Base Plate A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.
n.	Drive Motor (Prime Mover) The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified.
8.4	GYPSUM DISCHARGE CHUTE
a.	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.
b.	Chutes shall be made of minimum 20 mm thick TISCRAAL / 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.
c.	Complete chute work in the region of flap gates shall be fabricated from 20 thk TISCRAAL or equivalent. In case of vertical chute (valley angle more than 80 degree) complete chute, work shall be of 20 mm thick TISCRAAL 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.
8.4.1	CHUTE BLOCKAGE SWITCHES
a.	One no. chute blockage switch of proven type (subject to approval of the employer) shall be provided



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b.	Chute blockage switch shall trip the feeding conveyor in case of Chute blockage and protect the feeding conveyor equipment.						
8.5	PIPING / VALVES						
a.	All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends. The Supplier can provide slurry pipes of size lower than 3" made up of FRP material. <table><tr><th>Piping</th><th>MOC</th></tr><tr><td>Water line</td><td>Carbon steel</td></tr><tr><td>Slurry line</td><td>Carbon steel with rubber lining</td></tr></table>	Piping	MOC	Water line	Carbon steel	Slurry line	Carbon steel with rubber lining
Piping	MOC						
Water line	Carbon steel						
Slurry line	Carbon steel with rubber lining						
b.	The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly type. Motorized actuators shall be provided for valves requiring frequent operation as indicated in the relevant scheme.						
c.	The valves shall be of proven type and the supplier shall submit a detailed valve schedule for employer's approval. Reference list for previous installations for similar application shall also be furnished to the employer						
d.	The isolation valves shall be of knife gate type with rubber seats designed to prevent accumulation of solids on the valve seat.						
e.	Supplier shall provide all necessary arrangements for purging & flushing of all the process pipelines, equipment's etc.						
8.6	SECONDARY HYDRO-CYCLONE						
a.	Each set of secondary hydro-cyclone shall be provided with 10% spare hydro-cyclones.						
b.	The hydro-cyclone shall be of proven design. Hydro-cyclones shall be of modular construction. The secondary 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.						
c.	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.						



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8.7 Motor

8.7.1 General

This specification generally covers the requirement for motors involved in gypsum dewatering system package.

8.7.2 Voltage level:

The voltage level for motors shall be as follows:

S.No	Rating	Voltage	Freq and voltage variation
1	Upto 0.2 kw	Single phase 240V AC / Three phase 415V AC	1. 50 Hz- +3% & -5 % 2. 10% combined variation of voltage & frequency.
2	Above 0.2 and up to 200 kw	Three phase 415V AC	

8.7.3 Starting voltage requirement

Up to 85% of rated voltage for ratings below 110 KW

Up to 80% of rated voltage for ratings from 110 KW to 200 KW

- Voltage rating for special purpose motors viz, VFD shall be as per manufacturer's standard.

8.7.4 Degree of protection:

S.NO	Item	Indoor	Outdoor
1	Motors	IP 54	IP 55
2	Cable box	IP 54	IP 55

8.7.5 Efficiency class:

Premium efficiency IE3 (For Continuous duty motors up to 200 kw) as per IS 12615,IEC:60034-30

8.7.6 General requirements:

S.No	Parameters	To be confirmed by vendor	Vendors confirmation
1	Direction of rotation	Suitable for both directions	
2	Class of Insulation	Thermal class 155 (F) insulation	
3	Winding Insulation	The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method	



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4	Starting Current	1. Less than or equal to 600 % full load current subject to tolerance as per IS (Normal motor) 2. Less than or equal to 700 % full load current subject to tolerance as per IS (Normal motor)	
5	Starting Voltage	1. Up to 85% of rated voltage for ratings below 110 KW 2. Up to 80% of rated voltage for ratings from 110 KW to 200 KW	
6	Torque requirement	1. Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2. Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.	3.
7	Type of enclosure	1. Motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tubeventilated (TETV) or Closed air circuit air cooled (CACA) type. 2. VFD driven motors to be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor.	3.
8	Dimensions of Terminal box for LV motors	Motor MCR	Distance between centre of stud & gland plate (In mm)
		a. Upto 3 Kw b. Above 3 kw to 7 kw c. Above 7 kw to 13 kw d. Above 13 kw to 24kw e. Above 24 kw to 37kw f. Above 37 kw to 55kw g. Above 55 kw to 90kw	As per manufacturer's practise 85 115 167 196 249 277
9	Cable glands & Lugs	Double compression type Nickel plated brass cable gland & insulated tinned copper crimping lugs to suit the cable sizes	
10	Paint shade	RAL 5012 (Blue)	
11	Space heaters	Suitable single phase space heaters shall be provided on motors rated 30KW and above. Separate terminal box for space heaters shall be provided	

8.7.7 Locked rotor withstand time

S.No	Starting time at min permissible voltage	Locked rotor withstand time
1	Upto 20 secs	Under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time
2	More than 20 sec & less than 45 sec	Under hot condition at highest voltage limit shall be at least 5 secs. more than starting time

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3	More than 45 sec's	under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time

8.7.8 Special Requirement:

Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

8.7.9 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

8.8 JUNCTION BOX

8.8.1 GENERAL

This specification generally covers the requirement for Junction boxes involved in gypsum dewatering system package. The requirements are only indicative. If , any additional facility to be provided for satisfactory operation same shall be brought out.

8.8.2 DESIGN AND CONSTRUCTIONAL FEATURES

8.8.2.1 JUNCTION BOX:

- JB shall be of Thermoplastic or thermosetting or FRP type.
- The box shall be provided with the terminal blocks, mounting bracket and screws etc.
- The cable entry shall be through galvanized steel conduits of suitable diameter.
- The JB shall be suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures.
- The JB shall be of grey colour RAL 7035. All the metal parts shall be corrosion protected.
- JB's will be provided with captive screws so that screws don't fall off when cover is opened



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- JB's mounting brackets should be of powder coated MS.
- Class of protection shall be IP 55.

8.8.2.2 TERMINAL BLOCK

- Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade
- The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs.
- All terminal blocks shall be suitable for terminating on each side the required cables/wire size.
- All internal wiring shall be of cu. Conductor PVC wire.

8.9 INSTRUMENTS

8.9.1 General:

This section covers the specification for instruments involved in gypsum dewatering system.

Instruments as per attached list (Section 8.9.7) shall be minimum. Instruments that are required for satisfactory operation of the system though not indicated in the list shall also be supplied.

8.9.2 INSTRUMENTS:

8.9.2.1 General:

All transmitters, sensors, switches and gauges for parameters like pressure, level, flow etc. as required for the safe and efficient operation and maintenance of equipment in the system under the scope of specification shall be provided on as required basis.

8.9.2.2 Instrumentation valves:

The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis.

8.9.2.3

The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The necessary cables, flexible conduits, junction boxes and accessories for the above purpose shall also be supplied. Double



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root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

8.9.3 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS

Minimum technical requirements shall be as follows: -

- 8.9.3.1 Microprocessor based 2 wire loop powered electronic transmitter with 4-20 mA DC HART output signal shall be provided.
- 8.9.3.2 For calibration ranges greater than or equal to 400mmwc, accuracy of transmitter shall be ± 0.060 % of calibrated range(min), stability 0.25 % of calibrated range for 10 years and 50:1 turn down. For calibration ranges less than 400mmwc accuracy shall be ± 0.10 % of calibrated range (min) and 20:1 turndown.
- 8.9.3.3 Overpressure rating of transmitter shall be 150% of maximum operating pressure.
- 8.9.3.4 Transmitter shall have weather proof IP-67 metallic housing with durable corrosion resistant coating, integral digital display with self-indicating diagnostics, plug and socket type electrical connection, calibration using HART calibrator, 2/3/5 Valve non integral manifold and rack with canopy.

8.9.4 ULTRASONIC TYPE LEVEL TRANSMITTER, RADAR TYPE LEVEL TRANSMITTER

Minimum technical requirements shall be as follows: -

- 8.9.4.1 Microprocessor based 2 wire type, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol)
- 8.9.4.2 Accuracy ± 0.5 % of calibrated span or minimum 5 mm, Load impedance 500 Ohm (minimum)
- 8.9.4.3 Weather proof IP-65 metallic housing with durable corrosion resistant coating
- 8.9.4.4 Plug in socket type electrical connection, zero & span adjustment- temper proof remote as well as local from instrument, integral digital display and self-indicating type diagnostic features
- 8.9.4.5 Power supply 24V DC ± 10 %, calibration using hand held HART calibrator, temperature compensation built in the instrument (applicable for ultrasonic type only),



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- 8.9.4.6 It should be possible to calibrate the instrument without any level in the tank/sump etc. All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.
- 8.9.4.7 In case of Guided wave radar (GWR) type level transmitters coaxial probe of SS316L shall be provided. However, Rod probe, cable probe of SS316L can be used for applications wherever coaxial probe is not suitable.
- 8.9.4.8 External cage and other mounting accessories shall be provided where ever side mounting is required. Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor.
- 8.9.4.9 Four wire type transmitters can be provided for applications where 2- wire transmitter has some technical limitations. However, in such cases isolated 4-20 mA DC (analog) output shall be provided.

- 8.9.4.10 Power supply required for such transmitters shall be 24V DC.

For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.

- 8.9.4.11 Sonic frequency based transmitters can also be provided under “ultrasonic transmitters” category for powdery medium

8.9.5 SPECIFICATION FOR CORIOLIS FLOW TRANSMITTER

Minimum technical requirements shall be as follows: -

- 8.9.5.1 Microprocessor based, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol), accuracy $\pm 0.2\%$ of rate, repeatability $\pm 0.1\%$ of rate, material of wetted parts SS316, material of housing SS304L, weather proof.
- 8.9.5.2 Degree of protection shall be IP-65, Load impedance 500 Ohm (minimum), zero & span adjustment- temper proof remote as well as local from instrument, integral digital display, calibration using hand held HART calibrator.

8.9.6 LOCAL INSTRUMENT ENCLOSURE & LOCAL INSTRUMENT RACK:



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All transmitters, switches, etc. for Gypsum dewatering system and other system being provided under the contract shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant and (ii) In local instrument racks in case of covered areas.

8.9.7 LIST OF INSTRUMENTS:

8.9.7.1 Level Transmitter – For cake thickness sensor

8.9.7.2 Flow meter

- Process water to belt, cloth and cake washing
- Process water for belt lube water
- Seal water for vacuum Pump

8.9.7.3 Pressure gauge

- Washing water
- instrument air
- Vacuum receiver

8.9.7.4 Pressure switch

- Lubricating oil to mill bearing
- Vacuum receiver

8.9.7.5 Limit switch

- Cloth sway
- Pull code

8.9.7.6 Pressure Transmitter

- Process water

8.10 CONTROL CABLE



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1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).

Cable selection & Sizing :

Control cables shall be sized based on the following considerations:

- (a) The minimum conductor cross-section shall be 1.5 sq.mm.
- (b) The minimum number of spare cores in control cables shall be as follows:

No of cores in cable	Min No of spare cores
2C,3C	NIL
5C	1
7C, 12C	2
14C	3

8.11 INSTRUMENTATION CABLE

General:

This section covers the specification for instrumentation cables involved in gypsum dewatering system.

Instrumentation cable required for the gypsum dewatering system shall be supplied till the terminal of the local junction box. Termination of the cables in junction box shall also be in vendor's scope.



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SPECIFICATION OF INSTRUMENTATION CABLE

Common Requirements

S. No.	Property	Requirement
1	Operating Voltage	225 V (peak value)
2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IEC 60584, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.
3.	Continuous operation suitability	At 205 Deg C for Type-C cables & heat resistant cables, at 70 Deg C for all other type of cables.
4.	Marking :-	<i>a. Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath.</i> <i>b. Marking to read 'FRLS' to be provided at every 5 meters on outer sheath except for Type-C cable</i> <i>c. Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.</i>
5.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
6.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
7.	Ovality at any cross-section	Not more than 1.0 mm
8.	Color	The outer sheath shall be of blue color except for KX & SX extension cables. For KX & SX extension cables color of outer sheath shall be as per ANSI MC 96.1/ IEC 60584.
9.	Others	Repaired cables shall not be acceptable.



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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
A. CONDUCTORS				
Cross section area	0.5 sq. mm			
Conductor material	Type KX as per ANSI MC 96.1/ IEC 60584	Type SX as per ANSI MC 96.1/ IEC 60584	Annealed bare copper	
Colour code	As per ANSI MC 96.1/ IEC 60584	As per ANSI MC 96.1/ IEC 60584	As per VDE-815	
Conductor Grade	As per ANSI MC 96.1 / IEC 60584		Electrolytic	
No & dia of strands	7x0.3 mm (nom)			
No. of Pairs	2	2	2/4/8/12/16/24/48	
Max. conductor loop resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4	
Reference Standard	As per ANSI MC 96.1/ IEC 60584		VDE : 0815	
B. INSULATION				
Material	Extruded PVC type YI 3			
Thickness in mm (Min/Max)	0.25/0.35			
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.			
C. PAIRING & TWISTING				
Max. lay of pairs (mm)	50			
Single layer of binder tape on each pair provided	Each core printed with number or Numbered binder tape to be provided on each pair		Yes	
Bunch (Unit Formation) for more than 4P	N.A		To be provided	
Conductor /pair identification as per	N.A.		To be provided	



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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
VDE0815				
D. SHIELDING				
Type of shielding	Al-Mylar tape			
Individual pair shielding	No		To be provided for F-type cable	
Minimum thickness of Individual pair shielding	No		0.028mm (28 micron)	
Overall cable assembly shielding	To be provided			
Minimum thickness of Overall cable assembly shielding	0.055 mm (55 micron)			
Coverage / Overlapping	100% / 20%			
Drain wire provided for individual shield	N.A.		Yes (for F-type) Size- 0.5 sqmm No of strands-7 Dia of strands- 0.3mm Annealed Tin coated copper	
Drain wire provided for overall shield	Yes, Size- 0.5 sqmm, No of strands-7, Dia of strands- 0.3mm, Annealed Tin coated copper			
E. FILLERS (if applicable)				
Non-hygroscopic, flame retardant	To be provided			
F. OUTER SHEATH				
Material	Extruded PVC compound YM1 with FRLS properties			
Minimum Thickness at any point	1.8 mm			
Nominal Thickness at any point	>1.8 mm			
Resistant to water, fungus, termite & rodent attack	Required			



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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
Minimum Oxygen index as per ASTM-D-2863	29 %			
Minimum Temperature index as per ASTM-D-2863	250 deg.C			.
Maximum Acid gas generation by weight as per IEC-60754-1	20%			.
Maximum Smoke Density Rating as per ASTM-D-2843	60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTM-D-2843)			
Reference standard	VDE207 Part 5,VDE-816			
G. Electrical Parameters				
Mutual Capacitance Between Conductors At 0.8 KHz (Max.)	200 nF/km		120 nF/km for F type and 100 nF/km for G-type	
Insulation Resistance (Min.)	100 M Ohm/Km			
Cross Talk Figure (Min.) At 0.8 KHz	60 dB		60 dB	
Characteristic Impedance (Max) At 1 KHz	N.A.		320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	.
Attenuation Figure At 1 KHz (Max)	N.A.		1.2 db/km	
H. COMPLETE CABLE				
Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			



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9.0 PACKING AND FORWARDING

1.	Proper packing to be ensured. Indigenous Supply: GDS & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the GDS internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure - VI. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	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.
3.	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.
4.	Crates and packing material used for shipping will become the property of owner (NTPC)
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship 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.
6.	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.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number



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	c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. NTPC NATIONAL CAPITAL THERMAL POWER PROJECTS STAGE – II DADRI, 2 X 490 MW. UTTAR PRADESH INDIA 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.
9.	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.
10.	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.
11.	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 case in which a complete unit of equipment is packed.
12.	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)
13.	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
14.	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



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	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.
15.	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 GDS & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
16.	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 shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17.	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.
18.	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 10days of LOI.
19.	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).
20.	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.
10.0	SUPERVISION OF ERECTION 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 2 GDS. The bidder will be informed well in advance for the visit. Bidder shall include 15 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.



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11.0	EXCLUSION
	The following work associated with the GDS will be by BHEL: a. Civil foundations b. Walkways, platforms and ladders c. Element handling hoists d. Primary hydro cyclone feed tank & pump e. Secondary hydro cyclone feed tank & pump f. Filtrate water tank & pump g. Cake wash tank & belt filter cloth wash tank
12.0	INSPECTION AND TESTING
A)	Minimum Testing requirements to be considered are as below:
1.	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.
2.	List of Non-Destructive test over and above the material test are as follows: a. Mechanical Seal- Manufacturer's recommendation. b. Base Plate- Stress relieving of weld. c. Replaceable Rubber liner- Shore Hardness, Class and Type certificate
3.	Once mounting is finished and operation test will be conducted on each GDS to determine the characteristic curves. to determine the parameters at the design point, mechanical running & performance testing shall be performed & witnessed.
4.	Vibration test and Noise level test shall be witnessed
5.	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.
6.	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.
7.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.



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8.	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.
9.	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.
10.	Quality- Tests
	PUMPS:
i.	UT on shaft forgings (greater or equal to 40mm) and MPI/DPT shall be done on shafts and impeller to ensure freedom from defects.
ii.	The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut off head, whichever is higher. The test pressure shall be maintained for at least half an hour.
iii.	The pump rotating parts shall be subjected to static and dynamic balancing.
iv.	Noise and vibration shall be measured during the performance testing at shop.
v.	For Motors-Type test requirement ref Annexure-I(a)
	VACUUM BELT FILTERS
i.	Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.
ii.	UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.
iii.	All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.
iv.	Filter cloths and belts shall be tested for physical properties as per relevant standard
v.	Hydro cyclones shall be checked by visual, dimensional etc.
B)	General Inspection requirements to be considered are as below:
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by BHEL / NTPC prior to manufacture. Inspection of above mentioned tests by BHEL/ NTPC representative at bidder's works is envisaged.
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/NTPC.
3.	GDS will be inspected at the Bidder's works before dispatch or where the test facilities are available.



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4.	Vibration levels shall be measured during shop running/performance tests.
5.	Contract shaft seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition.
6.	GDS shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
7.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
8.	BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
9.	Bidder to arrange all calibrated gauges, Instruments during inspection.
10.	Mechanical running and the performance test shall be carried out.
13.0	PAINTING
1.	Surface Preparation : Power Tool Cleaning to St3 (SSPC-SP3)
2.	PRIMER COAT: - Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) – DFT: 60 microns. - Intermediate: One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 50μ
3.	FINISH COAT: One coats of Synthetic Enamel to IS 2932, DFT- 50μ/ coat Total DFT : 50 micron.
4.	COLOUR CODE (based on DIN 2403:2007-05 & DIN 5381) - Base: To be informed later - Lettering: To be informed later.
5.	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 BHEL / NTPC.
14.0	SPARES,TOOLS & TACKLES
14.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of the GDS. Start-up & commissioning spares are those spares which may be required during the start- up and commissioning of the equipment/system. All spares required for successful operation till



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	commissioning of GDS 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.
14.2	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.
15.0	PERFORMANCE GUARANTEE
	All performance tests for GDS shall be carried out 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 GDS and its accessories 2) Vendor shall Guarantee and demonstrate each Vacuum Belt Filter capacity of 32.10 TPH wet gypsum cake with an inlet solid concentration of not more than 45% wt. 3) The contractor 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 98% for 120 days and average target availability of 95% for 1 year. 7) Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 8) 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. 9) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ NTPC approval. 10) 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.
16.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
1.	POWER GUARANTEE



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	Bidder to specify the total guaranteed power per Gypsum Dewatering System (GDS) operating at the rated capacity in their offer
2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Total guaranteed power consumption for Gypsum Dewatering System (Gypsum Dewatering System) at rated capacity (32.1 TPH) shall be quoted by bidder. Lowest quoted guaranteed power consumption will be taken as base value. Bid prices of other bidders will be loaded @ 197,080 INR for every KW excess over the base value as per the formula given below. Adjustment factor for excess power consumption in INR = (GPC-BV) X PL X 1 No. of Working GDS stream GPC- Guaranteed Power Consumption quoted by bidder in KW BV- base Value i.e. lowest quoted power consumption in KW PL- Power Loading @ 197,080 INR/KW
17.0	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 INR per GDS = (GPC-APC) X P X 1 No. of Working GDS Where - GPC- Guaranteed Power Consumption quoted by bidder in KW - APC- Actual Power Consumption in KW - P- Penalty @ 197,080 INR per KW
18.0	WARRANTY
1.	The warranty period shall begin on the date of taking over by NTPC 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.
2.	In case of failure of the equipment to meet the guarantee, NTPC/BHEL reserves the right to reject the equipment. However, NTPC/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement.



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19.0	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 commissioning including top up requirements. 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 NTPC/BHEL's approval herein shall be furnished within 2 months of placement of Order. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL 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.
20.0	TRAINING
	Successful bidder shall provide comprehensive training for NTPC/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the GDS system - Operation & Maintenance, Troubleshooting etc.
21.0	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 NTPC 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.
22.0	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 per Annexure V. Annexure V documents are required for proper evaluation purpose and vendors are requested to comply with above in all respect.
B	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT
	The Successful bidder shall submit necessary data, documents and drawings for review, approval as specified under Annexure V.



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Drawings that are reviewed by the NTPC/ BHEL 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. NTPC/ BHEL 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 NTPC 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. 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 P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per NTPC 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.

23.0 REFERENCE DOCUMENTS

1. Typical Layout & elevation drawing of gypsum dewatering building.
2. Valve Material Specification (Doc. No. Dadri:Valve:001)



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24.0

ANNEXURES



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24.2

ANNEXURE – II- TECHNICAL DATA SHEET (to be submitted along with bid)

GYPSUM DEWATERING SYSTEM	BIDDER'S DATA
i) No. of Streams ii) No. of Streams Stand-by	
iii) Primary Hydro-cyclone a) Make / Model b) Number working c) Flow Capacity (m³/hr) d) Inlet Solid Concentration (% w/w) e) No. of Hydro-cyclone in each set f) No. of spare hydro-cyclone in each set	
iv) Vacuum Belt Filters (VBF) a) Manufacturer b) Model c) Dimensions (W x L x H) (m x m x m) d) Cloth Width (m) e) Cloth Length (m) f) No. Working / Stand-by g) Capacity (Guaranteed) Gypsum (Dry) (kg/hr) Gypsum (Slurry) (m³/hr) h) Inlet Flow Volume (m³/hr) Solid Concentration (% w/w) i) Gypsum Flow (Dry) kg/hr	



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j) Moisture Removed (%) k) No. of stages of cake washing / water flow (m³/hr) l) No. of stages of cloth washing / water flow (m³/hr) m) Design Pressure of Vacuum Chamber (kgf/cm²/a) n) Operating Pressure of Vacuum Chamber (kgf/cm²/a) o) Material / Thickness (mm) Casing Cloth Gypsum Discharge Hopper Vacuum Box p) Life of Cloth (hrs.) q) Type /Material of Carrying Belt r) Type / Material of Sealing Belt s) Life of Carrying Belt (hrs.) t) Life of Sealing Belt (hrs.) u) Automatic Cloth Tensioning Mechanism Provided YES/NO	
v) Vacuum Receiver Tank a) No. of Tank for each VBF b) Capacity (m³) c) Dimensions (Dia x Height) (mm x mm) d) Material / Thickness (mm) e) Lining Material / Thickness (mm)	
vi) Vacuum Pumps a) Make / Model	



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b) Type c) No. of Pumps for each Vacuum Belt Filter d) Rated Capacity Flow/ Head/ Power (m3/hr/mWCi/KW) e) Power Consumption (KW) f) Pump Speed (rpm) g) Motor Rating (KW) h) Motor Speed (rpm) i) Margins (Flow / Head) (% / %) j) Operating Pressure (kgf/cm2/a) k) Design Pressure (kgf/cm2/a) l) Material / Thickness (mm) of Base/Lining Casing Shaft Impeller m) Type of Seal n) Sealing Water Flow (m3/hrs) o) Bearing No. of Bearings Type of Bearings p) Type of coupling q) Whether Silencer Provided at Outlet YES/NO	
vii) Slurry Pipes i. Pipe size (mm) ii. Type of Joints a) Pipe to Pipe/Pipe to Fittings b) Fittings iii. Material / Thickness (mm) of Pipe	



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iv. Material Thickness of lining v. Estimated Life of liners (hrs.) vi. Slurry Solid concentration (w/w %) vii. Slurry Settling Velocity (m/s) viii. Pipe Velocity (m/s)	
viii) Cake wash pump 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)	
ix) Belt filter cloth wash pump 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)	
x) Secondary Waste Water Hydro-cyclone a) Make / Model	



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- | | |
|---|--|
| b) Number (working + standby) | |
| c) Flow Capacity (m ³ /hr.) | |
| d) Inlet Solid Concentration (% w/w) | |
| e) No. of Hydro-cyclone in each set | |
| f) No. of spare hydro-cyclone in each set | |

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



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1.12.2 Data Sheet

Dwg. No.										1		2					
Rev.										1		2		3		4	
BELT FILTER DATA SHEET (1/2)										Date							
Designed																	
Checked																	
Approved																	
Date														Checked			
Designed														Approved			
Service										Belt Filter		No. Req'd		Working		Spare	
												Total					
Regulation										Codes/Standards		Location		☐ Indoor		☐ Out door	
Process Data										Refer to process flow 2/5							
Design Data																	
Vacuum Belt Filter										Vacuum Pump		Vacuum Receiver		Hydrocyclone Package			
Type										Type		Type		No.			
Width										Capacity		Dia x T.L (H)		Feed Valve		☐ Yes ☐ No	
Length										Vacuum		hPa					
Filter Area										m ²							
Vacuum										hPa							
Cake Thickness										Max.							
(on Operation)										Min.							
										Nor.							
Filtrate Rate																	
Filtrate Area										m ³ /m ² ·h							
Cake Wash Area										m ³ /m ² ·h							
Filtrate Time																	
Filtrate Area										sec.							
Cake Wash Area										sec.							
Materials																	
Vacuum Belt Filter										Vacuum Pump		Vacuum Receiver		Hydrocyclone			
Structure										Casing		Body		Body			
Drive Belt										Rotor		Lining		Apex Valve			
Cloth										Shaft				Voltex Valve			
Drive Pulley																	
Motor																	
Vacuum Belt Filter										Vacuum Pump		Support Fan					
Type																	
Rated Output										kW		kW		kW			
Pole																	
Volt										V		V		V			
Phase										φ		φ		φ			
Cycle										Hz		Hz		Hz			
Scope of Supply														Accessories			
Belt Filter										☐ Yes ☐ No		Anchor Bolt		☐ Yes ☐ No			
Vacuum Pump										☐ Yes ☐ No		Cake Thickness Sensor		☐ Yes ☐ No			
Vacuum Receiver										☐ Yes ☐ No		Vacuum Header Pipe		☐ Yes ☐ No			
Hydrocyclone Package										☐ Yes ☐ No		Chute		☐ Yes ☐ No			
												Hopper		☐ Yes ☐ No			
												Piping		☐ Yes ☐ No			
												Valves		☐ Yes ☐ No			
												Control Panel		☐ Yes ☐ No			
												Vinyl Hose		☐ Yes ☐ No			
												Rubber Hose		☐ Yes ☐ No			
Weight (kg)																	
Vacuum Belt Filter										B/F Drive Unit		Vacuum Pump		Vacuum Receiver		Hydrocyclone	
Guarantee																	
Allowable Sound Level										dB(A) at		m distance		Suspended solids in filtrate		ppm	
Moisture content in by-product gypsum										wt%							
Chloride content in by-product gypsum										ppm							
Information																	
Blanks shall be filled out by the Vendor.																	
Minimum interval (operation stop to start up) : hr																	



TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS

DADRI:FGD:GDS:R01

BELT FILTER DATA SHEET (2/2)										Dwg. No		2/2	
Rev.										1		2	
Date										3		4	
Designed													
Checked													
Approved													
Date										Checked			
Designed										Approved			
No. Req'd										Working		Spare	
Total													
Location										☐ Indoor		☐ Outdoor	
This stream data is for 1 vacuum belt filter													
Condition : Min. Feed Flow Rate													
Stream No.		Hydrocyclone		Hydrocyclone		Belt Filter		By-product		Filtrate		Clarified	
Fluid		Feed Slurry		Overflow		Feed Slurry		Gypsum				Water	
Total Flow (m ³ /h)													
Total Flow (kg/h)													
Temp (°C)													
Solids (wt%)													
Solids Comp. (wt%)													
CaSO ₄ ·2H ₂ O													
CaCO ₃													
Fly Ash													
Other													
Total													
pH													
Cl ⁻ (mg/l)													
Stream No.		Vacuum Pump		Cake Wash		Filter Wash		Water +		Process water		Secondary HC	
Fluid		Seal Water		Water		Water		Solids				overflow	
Total Flow (m ³ /h)													
Total Flow (kg/h)													
Temp (°C)													
Solids (wt%)													
Solids Comp. (wt%)													
CaSO ₄ ·2H ₂ O													
CaCO ₃													
Fly Ash													
Other													
Total													
pH													
Cl ⁻ (mg/l)													
Stream No.		Air		Air		Instrument		Stream No.		Secondary HC			
Fluid		with mist				Air		Fluid		underflow			
Total Flow (m ³ /h-d)								Total Flow (m ³ /h)					
Total Flow (m ³ /h-w)								Total Flow (kg/h)					
Temp (°C)								Temp (°C)					
Press (Pa)								Solids (wt%)					
								Solids Comp. (wt%)					
								CaSO ₄ ·2H ₂ O					
								CaCO ₃					
								Fly Ash					
								Other					
								Total					
								pH					
								Cl ⁻ (mg/l)					

SIGNATURE OF BIDDER

NAME

DESIGNATION



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

24.3 ANNEXURE III- SCHEDULE OF GUARANTEES

Sl. No.	Description	Data
1.	Rated capacity of Vacuum Belt Filter (VBF) TPH	: Bidder to Provide
2.	Guaranteed power consumption at rated capacity kW	: Bidder to Provide
3.	Guaranteed a) gypsum cake moisture content % b) gypsum cake chloride content ppm	: Bidder to Provide : Bidder to Provide
4.	Guaranteed life of filter cloth hrs	: Bidder to Provide
5.	Guaranteed life of liners in hydrocyclone hrs	: Bidder to Provide
6.	Noise level at a distance of 1.0 meter horizontally from the equipment and 1.5m above operating floor dB(A)	: Bidder to Provide
7.	Maximum vibration (peak to peak amplitude at site) microns	: Bidder to Provide
8.	Equipment Availability (%) Equipment Availability for 120 days % Equipment Availability for 1 year %	: Bidder to Provide : Bidder to Provide

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.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

24.4

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

SI No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

24.5 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.	Annexure to qualification requirement- Attachment 3K.	1
9.	Proforma Packing List	1
10.	Shortest Manufacturing Time	1
11.	Approximate weight of each skid	1
12.	Required Electric power & other Utility List	1
13.	Deviation List	1
14.	General Assembly Drawing indicating dimension and civil loading details	1
15.	Gypsum dewatering building GA	1
16.	VBF Sizing Calculation	1
17.	Cross-sectional Drawing	1
18.	Scope of Supply	1
19.	Spare List (Recommended)	1
20.	Start-up & Commissioning Spares	1
21.	List of Special Tools	1
22.	Test Arrangement & Test procedure	1
23.	Rotor GD2 (kg-m2)	
24.	T-S curve	1
25.	Hoist/Crane requirement	1
26.	Catalogue	1
27.	Calculation of Motor rating, Bearing capacity and selection of coupling	1
28.	Bill of material along with material and code	1



TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM NTPC DADRI 2X490MW TPS

DADRI:FGD:GDS:R01

29.	Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipment.	1
30.	Erection, Operation & Maintenance manual with lubrication schedule	1
31.	Procedure for shop / site performance tests	1
32.	Time schedule for delivery.	1
33.	Quality Assurance Plan.	1
34.	Make of all bought out items.	1
35.	Deviation list	1
36.	Spares list.	1
37.	Hoist / Crane requirement.	1
38.	Reference list of similar projects executed.	1
39.	List of proposed makes and vendors	1
40.	Training program and schedule for BHEL/NTPC personnel	1
41.	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.	Annexure to qualification requirement- Attachment 3K.	1	2 weeks after contract
8.	Lubricating oil list	1	2 months after contract
9.	Special tools list	1	2 months after contract
10.	Installation and assembly procedure	1	4 months after contract



TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM NTPC DADRI 2X490MW TPS

DADRI:FGD:GDS:R01

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



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

Sl. No.	Description	No of copies After award of contract	Delivery Time
	document prior to the submission of the Operation and Maintenance Manual		
38.	Erection schedule and component list.	1	1 month after contract

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

24.6

ANNEXURE-VI TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING

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

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

	TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM NTPC DADRI 2X490MW TPS
DADRI:FGD:GDS:R01	
24.7	ANNEXURE-VII INSPECTION & TESTING

Refer to all clauses for Inspection & testing requirements.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

24.8

ANNEXURE-VIII HEALTH & SAFETY MANAGEMENT MANUAL

Refer to all clauses for Health & Safety requirements.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM NTPC DADRI 2X490MW TPS

DADRI:FGD:GDS:R01

ANNEXURE – I(a) - LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED:

The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip.
5. Temperature rise test.
6. Momentary excess torque test.
7. High voltage test.
8. Test for vibration severity of motor.
9. Test for noise levels of motor:
 - Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
10. Test for degree of protection
11. Over speed test.
12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1
 - All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
 - The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.



PART –II

O&M Spares and O&M Services For 10 years



**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

25	O & M Services for 10 Years Operation – Annual Maintenance Contract (AMC). O & M Services of Gypsum Dewatering System & its accessories to be taken up by Bidder at DADRI Site. The O & M services will be for a period of 10 years. <u>SCOPE OF O & M Services:</u> A) <u>Annual Maintenance Contract (AMC):</u> 1. The Bidder to carry out maintenance of Gypsum Dewatering System & accessories supplied for a period of 10 years. The contract shall cover both preventive maintenance & Minor / Major Overhauls. 2. All services call shall be attended at the earliest. 3. All spare parts required for the upkeep of the equipment's (Gypsum Dewatering System & it's accessories) to be stocked in advance or arranged within 2 - 3 days' time to ensure trouble free operation & to meet the 95 % availability as per specification. 4. The Bidder has to take necessary approval from site In-charge for carrying out necessary maintenance operation. 5. The bidder shall provide qualified technicians for carrying out the AMC at site. Necessary site support will be provided by BHEL. TA/DA, boarding and lodging of such technicians attending to AMC requirements shall be borne by the bidder and shall be included in AMC scope. B) <u>O & M Spares:</u> 1. All spares required for the upkeep of the equipments for 10 years operation is in the scope of the bidder. 2. The bidder will submit a separate list of spares required for AMC from a) 3- 4 years operation. b) 5-7 years operation. c) 8- 10 years operation Note: 0 -2 years covered in warranty clause. 3. The following is the minimum spare parts along with their break up price to be stocked by the bidder, if applicable. 1) Vacuum Belt Filter a) Filter cloth : 4 Sets b) Belt : 1 set c) Vacuum Box seals: 2 sets d) Drive Motor : 1 no 2) Vacuum Pumps a) Pump Impeller Assembly:1 no
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**TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS**

DADRI:FGD:GDS:R01

- b) Pump Bearing: 1 set
- c) Seals: 1 set
- d) Motor: 1 no
- 3) Vacuum Breaker Valves
 - a) Valve Assembly: 2 Set
 - b) Actuator: 2 set
- 4) Slurry Valves: 4 no of each type
- 5) Slurry Line Bends: 4 no of each type
- 6) Hydro-cyclones
 - a) Hydro-cyclone isolation valve: 10% of each type or 1 no whichever is higher
 - b) Hydro-cyclone: 10% of each type or 1 no whichever is higher
 - c) Hydro-cyclone rubber lining: 10% of each type or 1 no whichever is higher

C) GENERAL

1. The AMC (A) & O & M Spares (B) are part of the scope for 10 years up keep of the equipments.
2. Maintenance charges – AMC (A) & O&M Spares (B) together will be paid yearly on a pro-rata basis for 10 years.
3. The AMC (A) & O&M Spares (B) rate to be quoted separately with the main offer.
4. The Price offer for supply of Gypsum Dewatering System & 10 years AMC (A) & O&M Spares (B) of Gypsum Dewatering System & its accessories will be considered for Evaluation.
5. All spares to be used during AMC under this contract shall be strictly interchangeable with the parts for which they are intended for replacements.

VALVE MATERIAL SPECIFICATION

S. No.	Kinds of Valve	Operation	Service Line
1	Butterfly	ON-OFF	Process Line, Drain Line -a)
2	Diaphragm	ON-OFF	Washing Line, Drain Line, Sampling Line of Process Line -b)
3	Pinch	Regulation control -c)	pH meter inlet Line (if required)
4	Ball (Ceramic)	Regulation control -c)	Meter feed recirculation line (if required)

- a) For 50 and large piping
- b) For 25 piping
- c) Valve position will be fixed manually during commissioning period. Further adjustment is not required.

The following types of valves shall be used for Isolation Valve

- (a) Gate Valve for Utility Line (For General)
- (b) Butterfly Valve for Process Line and Utility Line (For General)
- (c) Knife Gate valve for Process Line (For washing)
- (d) Ball Valve for Utility Line (For General)
- (e) Diaphragm valve for Process Line (for Washing and others)

The following types of valves shall be used for Control Valve

- (a) Globe Valve for Utility Line (For General)
- (b) Needle Valve for Process Line (in case of sensitive control)
- (c) Pinch valve for Process Line (in case of little control)
- (d) Ceramic Ball Valve for Process Line (for General)
- (e) Butterfly Valve for Utility Line (for General)

The following connection type shall be applied for each valve

- (a) DN50 and Smaller: Socket weld, Screwed
- (b) DN65 and Larger: Butt weld, Flanged

Slurry Valves Specification:**1) Butterfly Valve:****Type: 1 – Butterfly Valve**

Class No :AA40, Fluid Name: Limestone Slurry, Process Water

1.	DN50 - DN150	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER LEVER.
2.	DN50 - DN150	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER AIR CYLINDER
3.	DN50 - DN150	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER ELECTRIC MOTOR WITH L.SWITCH
4.	DN200 - DN300	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER WHEEL WITH GEAR
5.	DN200 - DN300	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER AIR CYLINDER

6.	DN200 - DN300	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER ELECTRIC MOTOR WITH L.SWITCH

Type: 2 – Butterfly Valve

Class No :AA60, Fluid Name: Gypsum Slurry, Filtrate Slurry, Waste Water

1.	DN50 - DN150	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	HASTEALLOY-C
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER LEVER.
2.	DN50 - DN150	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	HASTEALLOY-C
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER AIR CYLINDER
3.	DN50 - DN150	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	HASTEALLOY-C
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER ELECTRIC MOTOR WITH L.SWITCH
4.	DN200 – DN600	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	HASTEALLOY-C
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER WHEEL WITH GEAR

5.	DN200 – DN600	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	HASTEALLOY-C
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER AIR CYLINDER
6.	DN200 – DN600	Valve Rating:	ASME-B16.34 CL.150
		Body:	A126-B
		Trim:	A351-CF8M
		Lining:	EPDM
		Bonnet	FF
		Connection:	WAFER
		Operation type:	WAFER ELECTRIC MOTOR WITH L.SWITCH

2) Ball Valve

Type: 1 – Ball Valve

Class No :AA40, Fluid Name: Limestone Slurry, Process Water

DN25 - DN150	Valve Rating:	ASME-B16.34 CL.150
	Body:	CERAMIC
	Trim:	CERAMIC
	Connection:	FF
	Operation type:	BALL LEVER/ FULL BORE

Type: 2 – Ball Valve

Class No :AA60, Fluid Name: Gypsum Slurry, Filtrate Slurry, Waste Water

DN25 - DN150	Valve Rating:	ASME-B16.34 CL.150
	Body:	CERAMIC
	Trim:	CERAMIC
	Connection:	FF
	Operation type:	BALL LEVER./ FULL BORE

3) Diaphragm Valve

Type: 1 – Diaphragm Valve

Class No :AA40, Fluid Name: Limestone Slurry, Process Water

DN25 – DN80	Valve Rating:	CL.150
	Body:	A126 Gr B
	Trim:	CHLOROPRENE RUBBER
	Lining:	RUBBER
	Connection:	FF
	Operation type:	Hand Wheel / Weir Type

Type: 2 – Diaphragm Valve

Class No :AA60, Fluid Name: Gypsum Slurry, Filtrate Slurry, Waste Water

DN25 – DN80	Valve Rating:	CL.150
	Body:	A126 Gr B
	Trim:	EPDM
	Lining:	RUBBER
	Connection:	FF
	Operation type:	Hand Wheel / Weir Type

4) Pinch Valve**Type: 1 – Pinch Valve**

Class No :AA40, Fluid Name: Limestone Slurry, Process Water

DN25 – DN150	Valve Rating:	CL.150
	Body:	A126 Gr B
	Trim:	CHLOROPRENE RUBBER
	Lining:	RUBBER
	Connection:	FF
	Operation type:	Hand Wheel

Type: 2 – Pinch Valve

Class No : AA60, Fluid Name: Gypsum Slurry, Filtrate Slurry, Waste Water

DN25 – DN150	Valve Rating:	CL.150
	Body:	A126 Gr B
	Trim:	CHLOROPRENE RUBBER
	Lining:	RUBBER
	Connection:	FF
	Operation type:	Hand Wheel

The above data is basic design data and may vary based on selected vendor's recommendations.

ANNEXURE-I- PROVENNESS CRITERIA

ANNEXURE-I- PROVENNESS CRITERIA			एनटीपीसी NTPC											
CLAUSE NO.	INTENT OF SPECIFICATION													
4.00.00	QUALIFYING REQUIREMENTS FOR EQUIPMENTS/SYSTEMS													
4.01.00	Provenness criteria for critical equipment, auxiliaries, systems and bought out items: The Bidder / Bidder's sub-vendor(s) is required to meet the Provenness criteria and/or qualification requirement for critical equipment, auxiliaries, system and bought out items as per criteria stipulated below:													
4.01.01	Vacuum Belt Filters for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder: <u>Type and Rating for Qualification</u> <table><tr><th>Sl. No.</th><th>Name of Equipment</th><th>Type of Equipment</th><th>Application</th><th>Equipment Rating</th></tr><tr><td>(g)</td><td>Vacuum Belt filters</td><td>Belt type</td><td>Wet Limestone based FGD application in Coal fired power plant</td><td>80% of the offered Vacuum Belt filter capacity</td></tr></table>				Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating	(g)	Vacuum Belt filters	Belt type	Wet Limestone based FGD application in Coal fired power plant	80% of the offered Vacuum Belt filter capacity
Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating										
(g)	Vacuum Belt filters	Belt type	Wet Limestone based FGD application in Coal fired power plant	80% of the offered Vacuum Belt filter capacity										
4.01.03	Bidder shall offer and supply only the type of the above equipment(s) for which he himself or the manufacturer proposed by the bidder for the above equipment(s) is qualified. The Provenness criteria for equipment (Vacuum Belt Filters) stipulated at Sl.No.4.01.01 (g) above shall also be considered acceptable provided the rating parameters (i.e., capacity) is covered within the operating regime of the respective Vacuum Belt Filters performance curve of the reference plant equipment. A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.01.01 above in India, can also manufacture such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s).													

CLAUSE NO.	INTENT OF SPECIFICATION
	Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later. 4.01.08 Before taking up the manufacturing of such equipment(s) as per clause 4.01.02, 4.01.03, 4.01.04, 4.01.05(i), 4.01.06 & 4.01.07 above, the Bidder / its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licensor's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licensor shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments. 4.01.09 Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licensor(s) proposed by the Bidder for the above equipment(s) is qualified. 4.01.10 The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract. Note to clause 4.01.01 (1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.

24.10 ATTACHMENT 3K - QUALIFICATION OF GYPSUM DEWATERING SYSTEM SUPPLIER

ATTACHMENT 3K
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**FOR
NCTPP DADRI ST-II (2X490 MW)
BIDDING DOCUMENT NO. CS-6130/0330-109-9**

Bidder's Name and Address:

To
Contract Services-II
NTPC Limited
Noida-201301

Summary of Critical Equipment indicated under clause 4.01.00, sub-Section-I, Part-A of Section-VI.

Equipment Name	Sub-Vendor Name	Collaborator's Name, if applicable	Seeking Qualification as per clause... Sub-Section-I, Part-A of Section-VI
Booster Fans			*4.01.01 /*4.01.02 /*4.01.03
*Slurry Recirculation Pumps			*4.01.01 /*4.01.03 /*4.01.07
Oxidation Blowers			*4.01.01 /*4.01.03 /*4.01.04
Wet limestone Grinding mills			*4.01.01 /*4.01.03 /*4.01.05 (i)/ 4.01.05 (ii)
Slurry Pumps			*4.01.01/*4.01.03
Agitators			*4.01.01 /*4.01.03 /*4.01.06
Vacuum Belt filters			*4.01.01 /*4.01.03

Note : *Strike-off whichever is not applicable.

1. If qualification sought as per clause 4.01.01, sub-Section-I-A, Part-A of Section-VI then the details of the sub vendor (manufacturer) shall be filled by the bidder in the format A to G.

2. If the qualification sought as per the clause 4.01.02, sub-section-I-A, Part-A of Section-VI, then the details of proposed sub-vendor (i.e. manufacturer of such equipments for at least 490 MW unit rating) shall be filled individually by the bidder in the format A and the details of collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be filled by the bidder in the format A separately. Further, in case of qualification vide clause 4.01.02, sub-section-I-A, Part-A of Section-VI a copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be furnished.
3. If the qualification sought as per the clause 4.01.03, sub-section-I-A, Part-A of Section-VI then the details of JV/Subsidiary Company formed for manufacturing of such equipments in India shall be furnished individually for each equipment by the bidder such as,
- i) Copy of document of incorporation of JV/Subsidiary company in India
 - ii) Copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI.
 - iii) Copy of document of at least 26% equity participation of qualified equipment manufacturer in the Indian JV company/subsidiary company directly or indirectly through its holding company /Subsidiary company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such JV/subsidiary or up to the end of defect liability period of the contract which ever is later.

Further, the details of collaborator or technology provider of the qualified equipment manufacturer who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall be filled by the Bidder in the format A to G (format given at 1.00.00). In addition to that, the sub-vendor along with the Indian JV company/subsidiary company, qualified equipment manufacturer and its holding company/subsidiary company as applicable shall furnish the DJU.

*** strike out whichever is not applicable.**

1.00.00

(Applicable for Bidder/his sub-vendors seeking qualification as per clause no. 4.01.01, Sub-section-I, Part-A of Section-VI. Bidder shall furnish the required data only for those equipments / auxiliaries which are proposed to be sourced under this route.)

We, hereby furnish the data on Provenness criteria for critical equipment, auxiliaries, systems and Bought Out Items such as Vacuum Belt filters which have been designed (either by self manufacturer or under valid ongoing collaboration and technology transfer agreement), *manufactured/ *got manufactured and supplied by us /Manufacturer (or manufactured/ got manufactured & supplied by our proposed sub-vendors) and these are in successful operation in at least one (1) plant for a period not less than one year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder. The details of type and minimum equipment rating of such equipment are given below

G. Vacuum Belt filters: We declare that, we/our Sub-Vendor, have designed (either by itself or under collaboration / licensing agreement), *manufactured/*got manufactured and supplied at least one (1) number of Vacuum Belt filter of minimum 80% of the offered Vacuum Belt filter capacity , Belt type, working in Wet Limestone based FGD application in Coal fired power plant and which has been in successful operation for minimum one(1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder, as per the details furnished below:

Reference Work

Sl. No. Description

1. Name of the reference plant & location:

2. Client name and his address:

3. No. of units and capacity in MW of unit:

4. Whether power plant is coal fired

-*Yes/*No

5. Whether operating in a Wet Limestone based FGD application in coal fired power plant

-*Yes/*No

6. Name of equipment manufacturer & address:

7. Date of commission of the equipment:

8. Model no. of the equipment:

9. Brief Technical particulars of the equipment:

10. Capacity-

.....TPH

SI. No.	Description	Reference Work
11.	Whether the equipment(s) are in successful operation in atleast one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
12.	Flue gas Desulphurization system details:	*Technical extract/ *paper letter/ *email/ *Drwaing from user or *contract docu ment or *scheme or *any document in public domain enclosed at annexure....to Attachment-3K
13.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure.....to Attachment-3K
14.	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.....to Attachment-3K

* Strike off whichever is not applicable.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

2.02.00

We further confirm that details in respect of collaboration / valid licencing agreement for the aforesaid equipment as per 2.01.00 above who meets the requirement stipulated at clause 4.01.01, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for these equipment which are in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below. We further confirm that we/ our sub vendor(s) have created manufacturing and testing facilities at our/ their works as per collaborator's/ Licensor's design, manufacturing & quality control system for these equipment(s)/ Auxiliary(ies).

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

*3.00.00

Applicable for JV Company/Subsidiary Company meeting provenness criteria as per clause no. 4.01.01, Sub section-IA, Part-A of Section-VI.

3.01.00

We, hereby confirm that JV company/ Subsidiary company (Strike off whichever is not applicable) formed for manufacturing and supply of equipment(s) (Vacuum Belt filters) has a valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 of sub-section-I, Part-A, Section VI of bidding documents (or the technology provider of the qualified equipment manufacturer). Further, in such a case, such qualified equipment manufacturers is having, directly or indirectly through its holding company/subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/subsidiary company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture / Subsidiary or up to the end of defect liability period of the contract, whichever is later. Before taking up the manufacturing of such equipment(s) (Vacuum Belt filters), we/ our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licensor's design, manufacturing and quality control system.

We further confirm that details in respect of collaboration / valid licensing agreement for the aforesaid equipment(s) (Vacuum Belt filters) who meets the requirement stipulated at clause 4.01.01, sub-section-I, Part-A, Section-VI for are enclosed at **Annexure-.....** to this Attachment.

sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of Provenness criteria for the qualified Wet Grinding Mill manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

We further confirm that *we/*our sub-vendors shall provide an extended warranty of three (3) years for the Wet Limestone Grinding Mills provide an additional on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

8.02.00

We further confirm that details in respect of collaboration / valid licencing agreement for the Vacuum Belt filters, between *us/*our sub-vendors, as per 7.01.00 above, and with qualified Vacuum Belt filters manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of provenness criteria for the qualified Vacuum Belt filters manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

We further confirm that before taking up the manufacturing of such Vacuum Belt filters, *we/ *our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

ANNEXURE-I

FORM OF DEED OF JOINT UNDERTAKING TO BE PROVIDED
FOR VACUUM BELT FILTERS
AS PER CLAUSE 4.01.05 (i) OF SUB-SECTION-I, PART A, SECTION VI
(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

DEED OF JOINT UNDERTAKING TO BE EXECUTED BY THE BIDDER/CONTRACTOR, QUALIFIED INDIAN MANUFACTURING COMPANY MEETING THE REQUIREMENTS SPECIFIED AT CLAUSE NO. 4.01.05 (i) OF SUB-SECTION-I, PART A, SECTION VI ALONGWITH QUALIFIED EQUIPMENT MANUFACTURER OF VACUUM BELT FILTERS MEETING THE REQUIREMENTS AS PER CLAUSE 4.01.01 (d) OF SUB-SECTION-I, PART A, SECTION VI FOR SUCCESSFUL PERFORMANCE OF VACUUM BELT FILTERS IN WHICH EXECUTANT OF THE DJU ARE JOINTLY AND SEVERALLY LIABLE FOR THE SUCCESSFUL PERFORMANCE OF THE VACUUM BELT FILTERS

The DEED OF UNDERTAKING executed this day of Two thousand by M/s a Company incorporated under having its Registered Office at (hereinafter called the "Bidder/Contractor", which expression shall include its successors, administrators, executors and permitted assigns) AND

**M/s a Vacuum Belt filters manufacturer as per the requirement of clause 4.01.05 (i) of sub-section-I, Part-A, Section-VI, incorporated under having its Registered Office at (hereinafter called the "Qualified Indian Manufacturing Company"), which expression shall include its successors, administrators, executors and permitted assigns) AND

M/s a Vacuum Belt filters manufacturer meeting the requirements of clause 4.01.01 (d) of sub-section-I, Part-A, Section-VI incorporated under having its Registered Office at (hereinafter called the "Qualified Equipment Manufacturer", which expression shall include its successors, administrators, executors and permitted assigns) AND

in favour of NTPC Limited, A Government of India Enterprise, incorporated under the Companies Act, 1956, having its Registered Office at NTPC Bhawan, Scope Complex, 7, Institutional Area, Lodhi Road, New Delhi-110003 INDIA (hereinafter called "NTPC" or "Employer" which expression shall include its successors, administrators, executors and assigns).

WHEREAS, the Employer invited Bids for design, engineering, manufacture, supply, transportation to site, construction, installation, testing, commissioning and conductance of guarantee tests for the for **NCTPP DADRI** (hereinafter referred to as "Plant") vide its Bidding Document No. **CS-6130/0330-109-9**.

ATTACHMENT 3K
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AND WHEREAS vide clause 4.01.05 (i) of Sub-Section-I, Part A, Section VI of bidding documents, it has been specified that a Qualified Indian Manufacturing Company can also manufacture equipment listed at clause no. 4.01.01 (d) of Sub-Section-I, Part A, Section VI for which it is qualified, provided that it has a valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing of Wet limestone Grinding mill in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01(d) of Sub-Section-I, Part-A, Section-VI of bidding documents. Before taking up the manufacturing of Wet limestone Grinding mill, the bidder/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/ licensor's design, manufacturing and quality control system for Wet limestone Grinding mill. In addition, the Bidder/Contractor along with the Qualified Indian Manufacturing Company, qualified equipment manufacturers shall furnish DJU for each equipment in which executant of the DJU shall be jointly and severally liable for the successful performance of the equipment.

WHEREAS M/s (Bidder/Contractor) has submitted its proposal in response to the aforesaid Invitation for Bid by the Employer bearing No. dated for for **NCTPP DADRI** (hereinafter referred to as "Plant") vide its Bidding Document No. **CS-6130/0330-109-9**.

AND WHEREAS M/s (Qualified Indian Manufacturing Company) meets the requirement of clause 4.01.05(i) of sub-section-I, Part-A, Section-VI and has a valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of (Name Of Equipment) in India with M/s who meets the requirements stipulated at clause 4.01.01 of Sub-Section-I, Part A, Section-VI of bidding documents.

AND WHEREAS M/s (Qualified Equipment Manufacturer) meets the requirements of clause 4.01.01 of sub-section-I, PartA, Section-VI for (Name Of Equipment).

The Bidder/Contractor along with the *Qualified Indian Manufacturing Company, Qualified Equipment Manufacturers, are required to jointly execute and furnish prior to the placement of order for (Name of equipment), an irrevocable Deed of Joint Undertaking and be jointly and severally responsible and bound unto the Employer for successful performance of the ...
(Name of Equipment)
for **NCTPP DADRI (Name of Project)** fully meeting the stipulated technical requirements, guaranteed parameters and characteristics as per the Bidding Documents, in the event the bid is accepted by the Employer resulting into a Contract.

NOW THEREFORE, THIS DEED WITNESSETH AS UNDER:

1. We the Qualified Equipment Manufacturer and the Qualified Indian Manufacturing Company and the Bidder/Contractor, do hereby declare and undertake that we shall be jointly and severally responsible to the Employer for the successful performance of the (Name of Equipment).
2. In case of any breach of the Contract committed by the Qualified Indian Manufacturing Company, we the Bidder/Contractor and Qualified Equipment Manufacturer do hereby undertake, declare and confirm that we shall be fully responsible for the successful performance of the (Name of Equipment) and undertake to carryout all the obligations and responsibilities under this Deed of Joint Undertaking in order to discharge the Qualified Indian Manufacturing Company obligations stipulated under the Contract. Further, if the Employer sustains any loss or damage on account of any breach of the Contract for the (Name of Equipment), we the Bidder/Contractor and Qualified Equipment Manufacturer jointly and severally undertake to promptly indemnify and pay such loss/damages caused to the Employer on its written demand without any demur, reservation, Contest or protest in any manner whatsoever. This is without prejudice to any rights of the Employer against the Contractor/ his Sub-Vendor under the Contract and/or guaranties. It shall not be necessary or obligatory for the Employer to first proceed against the Indian Qualified Indian Manufacturing Company / Bidder/Contractor before proceeding against the Qualified Equipment Manufacturer nor any extension of time or any relaxation given by the Employer to the Qualified Indian Manufacturing Company / **Bidder/Contractor shall prejudice any rights of the Employer under this Deed of Joint Undertaking to proceed against the Qualified Equipment Manufacturer.
3. The liability of the Contractor, his sub-vendor and Associate/Collaborator shall be limited to an amount equal to 100% of the value of the contract** between the contractor and the sub supplier for the equipment.
4. Without prejudice to the generality of the Undertaking in paragraph 1 above, the manner of achieving the objective set forth in paragraph 1 above shall be as follows:
 - (a) We the Qualified Equipment Manufacturer shall ensure that complete design, manufacturing, quality assurance and installation of the (Name of Equipment) is carried out inline with our manufacturing & quality drawings and procedures and shall be fully responsible for its compliance so as to ensure satisfactory, reliable, safe and trouble free performance of (Name of Equipment).

Further, we, the Qualified Equipment Manufacturer shall extend our quality surveillance/ supervision/ quality control to the Contractor during manufacture, erection, commissioning and performance testing, both at Qualified Indian Manufacturing Company's works and/ or at Employer's project site.

Further, the Qualified Equipment Manufacturer shall depute their technical experts from time to time to the Qualified Indian Manufacturing Company's works/ Employer's project site as required by the Employer and agreed to by Qualified Indian Manufacturing Company to facilitate the successful performance of the (Name of Equipment) as stipulated in the aforesaid Contract.

Further, the Qualified Equipment Manufacturer shall ensure proper design, manufacture, installation, testing and successful performance of the (Name of Equipment) under the said Contract in accordance with stipulations of Bidding Documents and if necessary, the Qualified Equipment Manufacturer shall advise the Qualified Indian Manufacturing Company suitable modifications of design and implement necessary corrective measures to discharge the obligations under the contract.

- (b) In the event Indian Qualified Indian Manufacturing Company /Contractor fail to demonstrate that the (Name of Equipment) meets the guaranteed parameters and demonstration parameters as specified in the contract, the Qualified Equipment Manufacturer shall promptly carry out all the corrective measures related to engineering services at their own expense and shall promptly provide corrected design to the Employer.
- (c) Implementation of the corrected design and all other necessary repairs, replacements, rectification or modifications to the (Name of Equipment) and payment of financial liabilities and penalties and fulfillment of all other contractual obligations as provided under the contract shall be the joint and severally responsibility of the Contractor and Qualified Indian Manufacturing Company and Qualified Equipment Manufacturer.

5. We, the Bidder/Contractor and Qualified Equipment Manufacturer and the Qualified Indian Manufacturing Company do hereby undertake and confirm that this Undertaking shall be irrevocable and shall not be revoked till ninety (90) days after the end of the defect liability period of the equipment covered under the Contract and further stipulate that the Undertaking herein contained shall terminate after ninety (90) days of satisfactory completion of such defect liability period. In case of delay in completion of defect liability period, the validity of this Deed of Joint Undertaking shall be extended by such period of delay. We further agree that this Undertaking shall be without any prejudice to the various liabilities of the Contractor including Contract Performance Security as well as other obligations of the Contractor in terms of the Contract.

6. The Bidder/Contractor and Qualified Equipment Manufacturer will be fully responsible for the quality of all the equipment/main assemblies/components manufactured at their works or at their Vendors' works or constructed at site, and their repair or replacement, if necessary, for incorporation in the Plant and timely delivery thereof to meet the completion schedule under the Contract.

7. In case of Award, in addition to the Contract Performance Security for the Contract, the Qualified Equipment Manufacturer shall furnish 'as security' an on demand Performance Bank Guarantee in favour of the Employer as per provisions of the bidding documents. The value of such Bank Guarantee shall be equal to **INR 10 Million (Indian Rupees Ten Million)** and it shall be guarantee towards the faithful performance /compliance of this Deed of Joint Undertaking in accordance with the terms and conditions specified herein. The bank guarantee shall be unconditional, irrevocable and valid till ninety (90) days beyond the end of defect liability period of the last equipment covered under the Contract. In case of delay in completion of the defect liability period, the validity of this Bank Guarantee shall be extended by the period of such delay. The guarantee amount shall be promptly paid to the Employer on demand without any demur, reservation, protest or contest.
8. Any dispute that may arise in connection with this Deed of Joint Undertaking shall be settled as per arbitration procedure/rules mentioned in the Contract Documents. This Deed of Joint Undertaking shall be construed and interpreted in accordance with the Laws of India and the Courts of Delhi shall have exclusive jurisdiction.
9. We, the Bidder/Contractor and Qualified Equipment Manufacturer and the Qualified Indian Manufacturing Company shall form an integral part of the Contracts from the date of signing of this Deed of Joint Undertaking. We further agree that this Deed of Joint Undertaking shall continue to be enforceable till its validity.
10. That this Deed of Joint Undertaking shall be operative from the effective date of signing of this Deed of Joint Undertaking.
- IN WITNESS WHEREOF, the Bidder/Contractor and Qualified Equipment Manufacturer and the Qualified Indian Manufacturing Company through their authorised representatives, have executed these presents and affixed common seal of their respective companies, on the day, month and year first mentioned above.

1. WITNESS

For M/s ...
(Bidder/Contractor)

(Signature of the Authorised Representative) ...

(Signature Name)

(Official Address)

Name ...

Designation ...

Common Seal of the
Company ...

1.	WITNESS	For M/s ... (Qualified Indian Manufacturing Company)
	(Signature Name) Representative) ...	(Signature of the Authorised
	(Official Address)	Name...
	Designation ...	Common Seal of the
	Company ...	
1.	WITNESS	For M/s ... (Qualified Equipment Manufacturer)
	(Signature Name)	(Signature of the Authorised Representative) ...
	(Official Address)	Name...
	Designation ...	Common Seal of the Company ...

Note : Power of Attorney of the persons signing the said Deed of Joint Undertaking is to be furnished. *

Contractor/Sub-Vendor shall strike out, whichever is not applicable

** copy of priced purchase order for the equipment/system shall be furnished by the Bidder.

