Corrigendum - 2 dated 19/12/2025 to CPC Tender No. BHEL/CPC/ RTP/EPC_AHP_CHP/26/051

Work Description - EPC PACKAGE FOR ASH HANDLING PLANT, COAL HANDLING PLANT and MILL REJECT HANDLING SYSTEM AT DVC RAGHUNATHPUR TPS PHASE-II (2X660MW) STEAM GENERATOR (SG) ISLAND PACKAGE.

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A) Some of the Bidders sought clarifications in regard to the published tender specification. The clarifications issued by BHEL are as below;

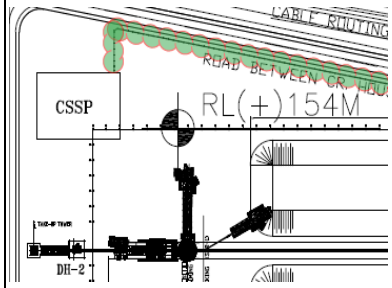
SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
1	DWG NO.-XXXX-001-POM-A-025 R0	Single Line Flow Diagram Of Bottom Ash Handling System (Jet Pump System) Ash Disposal & Ash Water System	Dewatering bin envisaged is 7 Nos. Kindly confirm the sizing criteria of DB. The volume of each DB shall be calculated considering 8 hrs. generation of BA and ECO per unit. Kindly Confirm.	Refer Specification for sizing criteria, provided along with Tender Documents
2	DWG NO.-XXXX-999-POM-A-029, R0	SINGLE LINE DIAGRAM FOR ASH CLASSIFER SYSTEM (FOR VACUUM CONVEYING)	We request to provide the capacity selection criteria for pressure conveying system below coarse and fine fly ash hopper.	Refer Specification for details, provided along with Tender Documents
3	Scope Matrix & terminal points for AHP & CHP EPC package (Clause C. 2)	Firefighting System for AHP, CHP, LHP & GHP	We request to keep the same in BHEL Scope as firefighting system other than specified zone is supplied by BHEL.	Tender Conditions Shall Prevail
4	Technical Specifications Section-VI, Part-A Sub-Section-IIA-16 Ash Handling System Clarifier for AWRS Water	One (1). no water clarifier along with its dosing system for AWRS water from dyke shall be provided within the plant boundary and near the ash water pump house	We understand that no Ash water recovery system along with clarifier has been envisaged for the proposed system. However, Supply of pipe for recovery system up to 5 m inside the plant boundary will be supplied by us. Kindly confirm.	Bidder to follow specification, provided along with Tender Documents. AWRS Clarifier with all its accessories like dosing system, pipes, pumps, instruments etc.., is in bidder's scope.
5	Technical Conditions Of Contract 3.87 Operation and Maintenance of Ash Handling System:	The Operation and Maintenance of this EPC package including all BHEL SUPPLIED Equipment's for this CHP, AHP and MRHS package till hand over of all the systems to Customer shall be in bidder scope.	Kindly confirm the duration for O&M. i.e is the O&M shall be carried out for 1 year from the date of commissioning of the plant.	Bidder to follow specification, provided along with Tender Documents.
6	Technical Conditions Of Contract Cl. 13.1.2 (b)	Bottom ash, Coarse ash and fly ash slurry	For design of the slurry pump, maximum pumping distance shall be considered is 7.2 KM with garlanding. Kindly confirm. However, supply of pipe is limited to 5 m inside the plant boundary.	Specification is clear. Slurry piping up to plant boundary is in bidder's scope.

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
7	XXXX-001A-POM-A-027 R (0)	SINGLE LINE FLOW DIAGRAM OF FLY ASH HANDLING SYSTEM (VACUUM SYSTEM)	As per drawing, 10 Nos coarse fly ash and 2 Nos fine fly ash pipe is connected to each main fly ash silo. No of pipe connected to main fly ash silo shall be as follows: - 1. From Buffer hopper 6Nos. / unit total 12 Nos for 2 units. 2. 4 Nos (2W+2S) pipe from below Coarse Fly Ash Hopper. 3. 2 Nos. (1W+1S) pipe from below Fine Fly Ash Hopper Thus total No of pipe above fly Ash silo shall be 18Nos. Please Confirm.	No. of ash pipe lines shall be as per system requirement. In case of vacuum conveying system, bidder's understanding is correct.
8	Annexure-18	Mill Reject Handling system	We have not found any flow diagram for MRHS system. We therefore request you to kindly provide the same for our better understanding.	Bidder to refer MRHS Flow Diagram attached along with this Corrigendum.
9	Technical Conditions Of Contract	Instrument Air Compressor.	We understand that IA compressor will be excluded from the present scope and the same shall be tapoff from the main Plant air compressor. However kindly confirm that any separate Instrument air is required in Silo area or not.	Specification is clear. Any other requirement for satisfactory operation/ completion of AHP system, shall be considered by the bidder in his scope.
10	Pre-Qualifying Requirements Cl. A Technical:	Bidder shall essentially meet all the Qualifying Requirements cited under. For the purpose of qualification, experience shall be reckoned as on 10.02.2025.	The tender published on 28.11.25 and the due date of submission is 15.12.25. For more no of competitive bidding the experience shall be from the due date of tender. Kindly look in to it.	Tender Conditions Shall Prevail
11	XXXX-999-POM-A-031 (SH-1) R0	LIME STONE FLOW DIAGRAM	We have not found any flow diagram for CHP for main plant system. We therefore request you to kindly provide the same for our better understanding.	Bidder to refer CHP Flow Diagram, attached along with this Corrigendum.
12	Technical Conditions Of Contract Cl. 13.2.1	Coal Handling Plant (CHP) in main plant area: bidder's scope starts from skirt board of conv. 19A/19B taking feed from DVC's conveyor 18A / 18B chutes at DVC's TP-17 and feeding coal to the respective RH & LH side bunker bays of Unit #3 & Unit #4	We request you to kindly furnish the detail of equipment along with clear flow diagram for our better understanding	Bidder to refer CHP Flow Diagram, attached along with this Corrigendum.
13	3-Annexure-1-Part1 Single Line Flow Diagram for Fly Ash Handling System (Vacuum system)	Flow Diagrams for Fly ash.	**Based on the 1st Stage Vacuum Conveying flow diagram from ESP for each unit:** Six fly ash conveying lines from the ESP buffer hoppers are shown discharging directly to the main FA silos or the classifier silo. After segregation in the classifier system, the fine fly ash hopper	Bidder to follow DVC specification and flow diagram.

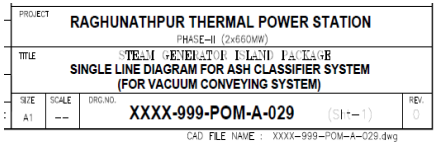
SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
	(XXXX-001A-POM-A-027 Rev.0		is connected to two fine ash discharge lines leading to the main fine ash silos, and the coarse fly ash hopper is connected to four discharge lines that can feed any of the three coarse ash silos. From this configuration, it appears that no separate, dedicated conveying pipelines have been considered from the classifier hoppers to the main fly ash silos. Instead, the design philosophy seems to rely on tapping the six conveying pipelines at suitable locations: first, at the nearest point for feeding the classifier system, and again at the outlet of the coarse and fine ash hoppers for routing the classified ash back into these running pipelines for onward conveying to the respective main silos. We therefore seek confirmation that the same six conveying lines are intended to serve both as inlet lines to the classifier and as discharge carriers from the classifier hoppers, and that no independent new pipelines are to be provided for this purpose. Accordingly, tapping is to be carried out at the nearest feasible locations—both for the inlet to the classifier silo and for the outlets from the classifier hoppers—so that classified ash can re-enter the existing conveying lines toward the main FA silos. **Based on the 1st Stage Pressure Conveying flow diagram from ESP for each unit** Ash from the ESP buffer hoppers is shown being conveyed either toward the classifier silo or toward the intermediate silo with slurrfier arrangement at discahrge. As discussed during the pre-bid meeting, intermediate silos are not to be considered in the present scope; therefore, ESP ash shall be routed only to the classifier system. In case ESP ash is also intended to discharge directly to the main FA silos, then similar to the vacuum conveying philosophy, tapping on the common conveying pipelines will be required at both the inlet side (towards classifier) and outlet side (from classifier hoppers) to allow proper routing of ash into and out of the classifier system. Further, the number of pressure conveying lines shown at the classifier hopper outlets (Coarse ash-12 nos) appears higher than the number of	

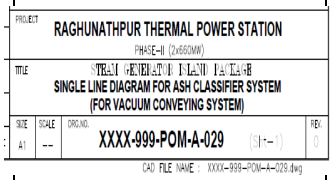
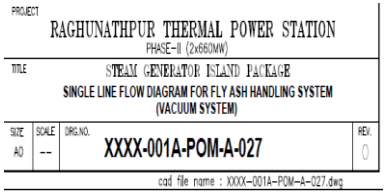
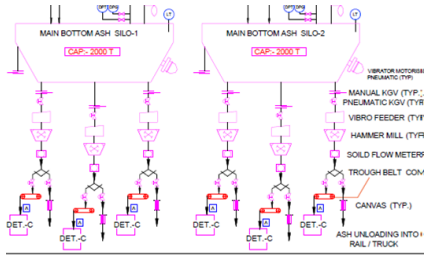
SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
			inlet points (Coarse ash-10 nos) at the main FA silos. Please clarify.	
14	06-Annexure-7-TCC, Section-VI_Part-B_Part-1	Two (2) fly ash main storage Silos shall be provided for both the units to receive ash from ESP Hoppers. Each fly ash main storage silo shall be of 2600 MT effective storage capacity. An additional fine ash silo of capacity 2600MT shall be provided at a separate location/adjacent to fly ash main storage silo having facility for feeding to the ash bagging plant.	We understand that the Fine Fly Ash Silos are also intended to be of RCC construction. Please confirm the required MOC.	Main fly ash Silo are RCC. Refer technical specification and clarifications by DVC
15	05-Annexure-7-TCC, Section-VI_Part-A_Part-1	Suitable numbers of fly ash storage silos (RCC Silo) & Suitable numbers of fine fly ash silo of effective storage capacity as specified		
16	06-Annexure-7-TCC, Section-VI_Part-B_Part-1	Storage capacity for Classifier Block Silos/Hoppers are as follows:Fine fly ash Hopper-300 (T), Coarse Fly ash Hopper-2 x 300 (T), Classifier Silo -250 (T).	We understand that the Classifier Silo,Fine Fly Hopper & coarse fly ash hopper to be steel construction. Please confirm the required MOC.	Refer technical specification and clarifications by DVC
17	General	Single Line Diagram/Plant Layout	Please provide the Main SLD in a readable format along with the plant layout with contour details in AutoCAD (DWG) format.	The AutoCAD (DWG) format will be provided during detail engineering to successful bidder. However, the required details are attached along with tender documents in PDF format.
18	General	Annexure-4, Plot Plan	As per Plot plan drawing, after crossing ESP area the belt conveyors & Piperack shown are running parallel to each other. We propose to combine the structure for pipe rack & belt conveyors wherever possible.	The same shall be reviewed during detailed engineering along with Customer.

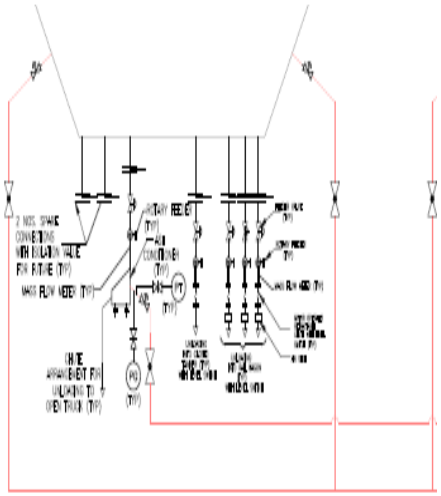
SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
19	01_Tender Document_Part1	The Operation and Maintenance of this EPC package including all BHEL SUPPLIED Equipment's for this CHP, AHP and MRHS package till hand over of all the systems to Customer shall be in bidder scope.	We understand that BHEL supplied equipment's means that free supplied equipments for CHP, AHP and MRHS package.	Bidder Understanding is correct.
20	Electrical Scope matrix Annexure-3,	Note : HT motor for any other application other than Conveyors, Water and Slurry Pump is in bidders scope.	we understand that rest motor like for compressor will be in bidder scope.	Specification is clear. Bidder to follow specifications.
21	Electrical Scope matrix Annexure-3,	BHEL Free issue HT motor 3.3KV	BHEL Free issue motor of 3.3KV is 29 however total feeder consider in HT panel as 51 nos for 3.3KV HT motor. Means rest motor will be considered by AHP vendor. BHEL to confirm	Specification is clear. Bidder to follow specifications, provided along with Tender Documents.
22	Electrical Scope matrix Annexure-3,		BHEL to confirm 11KV and 3.3KV HT panel incomer rating for consideration of HT cable in estimation.	Bidder to follow specifications, provided along with Tender Documents.
23	Electrical Scope matrix Annexure-3,	Roof Top Solar System	Roof top solar system: BHEL to confirm actual plant load of solar system so that same to be considered 50KWH of total solar plant load as mention. And these will be installed on MCC roof top.	Bidder to follow DVC specification relevant chapters in this regard.
24	01_TECHNICAL CONDITION OF CONTRACT Cl. No. 3.7 DESIGN BASIS / INPUTS For Ash Handling System page 14 of 94	1) Refer DVC NIT specifications for Ash Handling System. 2) Refer Annexure-17 for Ash collection data. 3) The Following sludges shall be discharged to ash slurry sump. The same shall be considered during the design of slurry disposal system. a) ETP RO ... ash slurry sump @120 m3/hr on continuous basis. TDS shall be approximately.... 11000 PPM. b) ETP c..... ash slurry sump @ 15 M3/hr on continuous basis. .... 1100 PPM. Additional make up water to be considered in case the above sludge is not coming to slurry sump.	Owner to clarify that these specified sludges in referred clause needs to be considered either for sizing of combined ash slurry pump or bottom ash slurry transportation pump.	Refer flow diagram for the same

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
25	01_TECHNICAL CONDITION OF CONTRACT Cl. No. 13.2.7 ZERO LIQUID DISCHARGE SYSTEM: page 72 of 94	Complete zero liquid discharge system for achieving effective separation of plant water from storm water, plant water collection, its transfer, treatment & recycle/reuse of area wash water (plant water) generated from entire CHP (IN MAIN PLANT AREA) and pumping up to a) inlet of coal slurry settling pond from CHP (IN MAIN PLANT AREA) as per BHEL NIT/end user's technical specification shall be in bidder's scope.	1) Bidder understand that transfer of area wash water from the Bidder's scope CHP area only shall be in Bidder's scope. Kindly confirm. 2) Please provide the coordinate of coal slurry settling pond (IN MAIN PLANT AREA) as required for pump / pipe sizing. 3) Bidder understand that there is no separate equipment / facilities except as specified are in Bidder's scope to make plant ZLD compliant. Kindly confirm.	1. Complete zero liquid discharge system for entire CHP (IN MAIN PLANT AREA) shall be in bidder's scope. 2. Tentative location of coal slurry settling pond (identified as CSSP in plot plan) is shown in the plot plan (Doc no. PE-DG-528-100-M001, Rev. 2P) enclosed in annexure-4 of tender documents.  3. Complete zero liquid discharge system for entire CHP (IN MAIN PLANT AREA) for achieving effective separation of plant water from storm water, plant water collection, its transfer, treatment & recycle/reuse of area wash water (plant water) generated from entire CHP (IN MAIN PLANT AREA) and pumping up to inlet of coal slurry settling pond from CHP (IN MAIN PLANT AREA) as per BHEL NIT/end user's technical specification shall be in bidder's scope.

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
26	17. Annexure-17 Ash Collection Data Page 2 of 22 TECHNICAL SPECIFICATIONS SECTION-VI, PART B SUB-SECTION: A-21 ASH HANDLING PLANT Page 1 of 41	4) Additional Information (per boiler) Description / Temp. °C / Pressure mmwc / No. of Hoppers # / Elevation of Hopper Bottom m Furnace Bottom Ash Hoppers / 1100 / -40 / 1 i) i) Temp. of bottom ash for calculating cooling water requirements : 1050°C	Due to discrepancy in referred clause, Owner to provide the bottom ash temperature needs to be considered for calculating the cooling water requirement for bottom ash.	Bidder shall consider 1100 Deg C for cooling water calculation
27	Technical Specifications Section-VI, PART-A Sub-Section: IIA-16 Ash Handling System Page 14 of 17 Technical Specifications Section-VI, PART B Sub-Section: A-14 Not Used	1.01.10 Clarifier for AWRS Water One (1). no water clarifier ..... to the clarifier shall be limited to 1500m3/hr. .... The design/sizing of the clarifier shall be **as per chapter A-14, Part-B of the technical specification**. .....through gravity flow/pumping system if required. SUB-SECTION–A-14 NOT USED	Sub section - A - 14 is not available in tender to design the ash clarifier as mentioned in referred Part-A. Owner to check & Provide the Same.	Bidder to refer Sub-section-A-14, attached along with this Corrigendum.
28	Technical Specifications Section-VI, PART-A Sub-Section: IIA-16 Ash Handling System Page 14 of 17 Technical Specifications Section-VI, PART B Sub-Section: A-01 Equipment Sizing Criteria Page 41 of 53	(h) Decanted water shall be pumped from owners' ..... maximum recovery water received inside plant shall be 1500 m3/hr, accordingly pipeline of diameter 600 NB, within plant boundary up to terminal point shall be in Bidder's scope. Decanted water from ash pond shall be reused in Ash handling System. (H) Rated flow of pumps shall be used for determining the pipe sizes. Further the following line velocities shall be considered for estimating the line sizes of water pipes and Air Pipes: S. N. / Service / Velocity, M/Sec Pipe size below 50 mm / Pipe size of 50 to 150 mm / Pipe size of 200 mm and above a) Water pump Suction 0.6-0.9 1.2-1.5 1.2-1.5 b) Water Pump Discharge 0.9-1.8 1.5-2.4 1.8-2.8	Considering the total flow 1500 m3/hr & 600 NB (6.3 mm the) pipe, velocity of water comes ~1.48 m/s, whereas minimum velocity is defined as 1.8 m/s. Owner is requested to check & confirm recovery water pipe size.	Bidder to follow specification. The same shall be reviewed during detail engineering.

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
29	Technical Specifications Section-VI, PART-A Sub-Section: IIA-16 Ash Handling System Page 15 of 17	1.06.00 Complete AWRS piping with all fittings from plant boundary to ash water sump.	Kindly confirm that AWRS pipe shall be terminated in ash water sump or AHP clarifier.	Recovery water pipe shall be terminated in AHP clarifier.
30	Technical Specifications Section-VI, PART-A Sub-Section: IIA-16 Ash Handling System Page 8 of 17 4. Annexure-4 Plot plan and Flow Diagram_Part1	(e) The fine ash and coarse ash after classification shall be stored in separate RCC hoppers/structural steel hoppers, fine ash hopper and coarse ash hopper respectively. The capacity of the fine ash hopper (01 no) and coarse ash hopper (02 no) shall be as specified elsewhere. One (1) no. Fine Fly ash Hopper & One (1) no. Coarse Fly Ash Hopper are shown in referred Flow Diagram.  PROJECT: RAGHUNATHPUR THERMAL POWER STATION PHASE–II (2x660MW) TITLE: STEAM GENERATOR ISLAND PACKAGE SINGLE LINE DIAGRAM FOR ASH CLASSIFIER SYSTEM (FOR VACUUM CONVEYING SYSTEM) SIZE: A1 SCALE: -- DRG.NO.: XXXX-999-POM-A-029 REV: 0 CAD FILE NAME : XXXX–999–POM–A–029.dwg	There is discrepancy in the quantity of Coarse Fly Ash Hopper to be consider, if Bidder Select the Vacuum conveying System. Owner to Check & confirm the total quantity of Coarse Fly Ash Hopper considering the Vacuum conveying System	Refer technical specification and clarifications by DVC
31	Technical Specifications Section-VI, PART-A Sub-Section: IIA-16 Ash Handling System Page 7 of 17 4. Annexure-4 Plot plan and Flow  PROJECT: RAGHUNATHPUR THERMAL POWER STATION PHASE–II (2x660MW) TITLE: STEAM GENERATOR ISLAND PACKAGE SINGLE LINE FLOW DIAGRAM FOR FLY ASH HANDLING SYSTEM (VACUUM SYSTEM) SIZE: A0 SCALE: -- DRG.NO.: XXXX-001A-POM-A-027 REV: 0 cad file name : XXXX–001A–POM–A–027.dwg	(D) Dry Fly Ash Transportation system from Buffer Hoppers to Ash Classifier System (a) Suitable nos. of screw type transport air compressors for each unit along with silencer, filter, after cooler along with all other accessories and supporting structures, platforms etc. as specified and as required. Fly Ash conveying line from Buffer hoppers as shown to main fly ash silo with the branching to ash classifier system.	1) Bidder understand that transport air compressor shall be designed to convey the fly ash from buffer hopper to ash classifier silo and not to main fly ash silo and fly ash from ash classifier area to main fly ash silo shall be conveyed via compressor located in ash classifier area. Kindly confirm. 2) In reference to above sl. no. 1, Bidder understand that Total 12 (6W+6S) fly ash pipes for both units shall be provided from buffer hoppers to ash classifier silo. Kindly confirm.	Refer technical specification and clarifications by DVC

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
32	4. Annexure-4 Plot plan and Flow Diagram_Part1 	Total Fly pipe lines above the fly ash silo 	1) In drawing no. XXXX-999-POM-A-027, total twelve (12) nos. fly ash lines from both units shown on the FA silo, whereas in drawing no. XXXX-999-POM-A-029, total Six (6) (4 from coarse fly ash hopper & 2 from Fine fly ash Hopper), Due to discrepancy, Owner is requested to kindly confirm the total no. of FA lines over main fly ash silo. 2) Bidder understand that total five (5) (3W+2SB) transport air compressor shall be common for both the units, kindly confirm.	Refer technical specification and clarifications by DVC
33	General	General	Please share the ash particle size analysis report at ECO Outlet, APH & AH-ESP Duct Hoppers for system design.	Details shall be provided during detail engineering
34	General	General	We request the General Arrangement (GA) Drawing, showing Plan & Elevation for the ECO, ECO DUCT, APH and DUCT Ash Hoppers along with their positions w.r.t. the nearest platform. Additionally, please provide the expansion details for each Ash Hopper.	Details shall be provided during detail engineering
35	Single Line Diagram for Fly Ash Handling System	As per the said Flow Diagram there are 01 Fly Ash Silos. But at the same time as per there are 02 Nos. Fly Ash Silos. 	Please confirm the final quantity of Fly Ash Silo & storage capacity of each to be considered	The quantity of Main silos is 3 Nos (including Fine fly ash silo)
36	Annexure -2-Scope matrix: Scope Matrix & terminal points for AHP & CHP EPC package		We request you kindly share the soft copy of the said document.	Bidder to refer to the documents attached as part of the tender document.
37	Annexure -2-Scope matrix: Scope Matrix & terminal points for	B) Coal Conveying System in the Main Plant	We request you kindly share the Flow Scheme of Coal Handling System for our reference.	Bidder to refer CHP flow Diagram, attached along with this Corrigendum.

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
	AHP & CHP EPC package			
38	Annexure -2-Scope matrix: Scope Matrix & terminal points for AHP & CHP EPC package	C) COMMON FOR AHP, CHP, LHP & GHP	We understand that LHP & GHP are not the part of the subject tender. Please confirm.	LHP & GHP are not the part of the subject tender. Bidder to refer Revised Annexure-2 Rev01 (Scope Matrix for AHP & CHP EPC Package).
39	Single Line Diagram for Fly Ash Handling System	As per the Tender Specification and subsequent said Flow Scheme, unloading system below each Fly Ash Silo as under: 	As per the tender flow scheme, below each Fly Ash Silo, there are 07 Nos. discharge openings: 01 No. via Ash Conditioner System for open Trucks 01 No. via Unloading Spout System for Closed Truck/ Tanker 03 Nos. via Unloading Spout System for Closed Type Rail Wagon Loading System 02 Nos. Future requirement Further, it is envisaged that "The pitching of ash silo and overall arrangement of hydro-mix conditioner units, telescopic chutes, air slides etc shall facilitate simultaneous loading of five wagons (BOXN/ BCFC/ BCCW/ BTAP) from three number of RCC Silos. Suitable positioning arrangement for Control of movement of Telescopic spout shall have to be provided in all three X-Y-Z directions to facilitate loading of ash into Wagons. While loading ash in wagons, top lids of wagons need to be accessed. For ensuring safety while accessing the top of wagon, a suitable platform at approx. height of 4.5 Mtrs above railway track all along the length of track in silo area shall be provided." In this regard, 1) We wish to inform you that as 01 No. Ash Conditioner System is envisaged below each Fly Ash Silo. Hence loading of Fly Ash in 05 Nos. BOXN Type Rail Wagon from 03 Nos. Fly Ash Silo is not possible and only 03 Nos. Rail Wagon can be filled. Please confirm? 2) As there are 03 Nos. Unloading Spout system is envisaged below each Fly Ash Silo for Rail Wagon Loading System and total 09 Nos. Unloading Spout System below all the three Fly Ash Silo to loading the 05 Nos. BCFC/ BCCW/	Specification is clear. Bidder to follow the same.

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
			BTAP Type Rail Wagon. We understand that 01 No. Unloading Spout System shall be used to load any one of Rail Wagon. Please confirm?	
40	Drawing No.: XXXX-999-POM-A-029	Single Line Diagram for Fly Ash Classification System (For Pressure Conveying System)	In the said Flow Scheme, 02 Nos. (1W+1Sb) Coarse Fly Ash Hoppers & 01 No. Fine Fly Ash Hoppers is envisaged for Fly Ash Classification System for all the three units. #) 01 No. Fly Ash Classifier is shown at the top of Working Coarse Fly Ash Buffer Hopper. #) There are 06 Sets. of Ash Conveying system below each Coarse Fly Ash Hopper & 02 sets. (01W 01Sb) below Fine Fly Ash Hopper. #) There are 11 Nos. (07W+04Sb) Conveying Air Compressors. We have internally discussed the scheme and did the calculation for selection of Fly Ash Conveying System's line capacity from each of Coarse & Fine Fly Ash Hoppers to Main Fly Ash Silos and wish to inform you that followings: **#)** There will be no working & standby Coarse Fly Ash Hopper and both the buffer hopper should be naming as working. **#)** There will be 01 No. Fly Ash Classifier for one unit and total 02 Nos. Fly Ash Classifiers for both the units. **The operation sequence of Fly Ash Conveying/ Transportation System from Coarse & Fine Fly Ash Hoppers to Main Fly Ash Silos will be:** **Case-1:** In normal plant operation, when no Fly Ash Classification System (of any Unit) is to be done. **Case-2**: During Fly Ash Classification of any 01 Unit, selected Fly Ash System conveying line capacity (from each of Coarse & Fine Fly Ash Hoppers) will be sufficient to convey the Fly Ash upto the Main Fly Ash Silo. **Case-3:** But during Fly Ash Classification of 02 Units, results in collection of Fine Fly Ash on higher side and accordingly both the Conveying System/ Stream (below Fine Fly Ash Hoppers) will be required to operate to convey the Fine Fly Ash. Considering above 7-8 Nos. Conveying System/ Stream	Specification is clear. Bidder to follow the same.

SL. NO.	Reference Clause	Specification	Bidder's Query	BHEL's Clarification
			(average conveying capacity 95-100 TPH) below 02 Nos. Coarse & 01 No. Fine Fly Ash Hopper will be in operation via 07 Nos. working Conveying Air Compressors.	

Note:

1) **All other terms and conditions against this NIT shall remain unchanged.**
2) **This corrigendum is to be submitted duly signed and stamped along with the Techno-commercial bid (Part- I).**

for BHARAT HEAVY ELECTRICALS LTD
Manager/ SCT- CPC

Corrigendum - 2 dated 19/12/2025 to CPC Tender No. BHEL/CPC/ RTP/EPC_AHP_CHP/26/051

REVISED ANNEXURE-02 – SCOPE MATRIX FOR AHP & CHP EPC PACKAGE

2x660 MW DVC RAGHUNATHPUR TPS PHASE-II, STEAM GENERATOR (SG) ISLAND PACKAGE

Scope Matrix & terminal points for AHP & CHP EPC package Rev-01

BROAD SCOPE: The scope for complete Ash handling system and Coal Handling Systems shall include complete design, engineering, manufacture, fabrication, assembly, testing & inspection at manufacturer's works, painting, supply, packing, despatch, transportation, delivery to site, receipt,unloading, intra site handling & storage at site, construction of Stores at site (Open & Closed), round the clock security at open storage yard , closed storage shed & erected material till completion of work, construction, erection, its supervision,statutory requirement (if any), testing ,inspection, commissioning, performance guarantee test and handing over to Owner, including all associated Mechanical, Electrical, Control &Instrumentation works, all auxiliary systems, Civil & Structural steel works, Architectural works, maintenance tools & tackles, mandatory spares, start-up and commissioning spares, lubricants & consumables as specified in tender specification, amendments & agreements till placement of order & as necessary for completeness in all respects and for efficient & trouble free operation for 2X660 MW DVC Raghunathpur TPS Phase-II.

Sl. No./ Chapter	Description	SCOPE IN AGENCY (EPC PKG VENDOR/BHEL)	Broad Scope	DETAIL SCOPE				Terminal Points Description	Remarks
				DESIGN / ENGG	CIVIL/ STR/ ARCH (SUPPLY & ERECTION / EXECUTION)	SUPPLY & ERECTION (MECH, ELEC, C&I)	TESTING / COMMISIONING		
A	**ASH HANDLING SYSTEM**								
1	Complete Ash handling plant as per descriptions given in NIT specification (DVC bidding document No.: DVC/C&M/Engineering/ RTPS Ph-II/EPC/SG), BHEL technical enquiry specification and subsequent amendments, clarifications if any till placement of order.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	**AHP:** Broad scope starts from (i) the outlet flange of ESP, APH, Duct, SCR inlet, SCR outlet and Economizer hoppers. Counter flanges at the outlet of respective hoppers shall be in EPC Package vendor's scope. (ii) the boiler furnace bottom (Scallop bar and seal plates are in BHEL's scope).	1. Ash handling system flow diagram and plot plan are enclosed
2	Complete Auxiliary system for the Ash handling system like Air conditioning, Ventilation, zero liquid discharge/effluent system, Water systems [Service Water, Potable water, Raw/ CTBD water,DMCW water, clarified water] ,Instrument air, weigh bridge, Hoists, Cranes, Elevator, sump pumps etc...as per descriptions given in NIT specification (DVC bidding document No.: DVC/C&M/Engineering /RTPS Ph-II/ EPC/SG), BHEL technical enquiry specification and subsequent amendments, clarifications if any till placement of order.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	Following water/air shall be terminated at Terminal point as per BHEL specification. Installation of Isolation valves and valve station with instrumentation at the tapping point and further distribution to the Application points shall be done by EPC package vendor. (a) Raw water/CTBD water/Service water/potable water: Refer Section-VI,Part-A, Sub-section-III of Technical specification. (b) DMCW (passivated): (i) 10m near Compressor house-1 (ii) 10m near BA Slurry pump house (c) Instrument Air with Air recievers: (i)1 No. at ESP area Unit-1, (ii)1 No. at ESP area Unit-2 (iii)1 No. at FA Silo area (d) Service air: 1 point at ESP Unit-1	
B	**COAL CONVEYING SYSTEM IN THE MAIN PLANT**								
1	Complete **Coal handling plant (Coal conveying system in main plant area)** as per descriptions given in DVC/NTPC tender specifications (Document no. DVC/C&M/Engineering/RTPS Ph-II/EPC/SG), BHEL technical enquiry specification and subsequent amendments & clarifications, if any till placement of order.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	**CHP:** 1. Broad scope starts from skirt board of conv. 19A/19B taking feed from DVC's conveyor 18A / 18B chutes at DVC's TP-17) and feeding coal to the respective RH & LH side bunker bays of Unit #3 & Unit#4 by Mobile Trippers # 1,#2, #3 & #4 as marked & demarcated in the enclosed flow diagram. 2. Support bracket for gallery in Bunker building column shall be provided by BHEL. Required Stool Pieces is in EPC Vendor Scope. 3. Only RCC foundation of Conveyors Equipment above bunker bay shall be provided by BHEL. 4. Bunker Bay ventilation shall be in EPC vendor's scope.	1. Coal Flow Diagram for CHP System demarcating terminal points is enclosed. 2. Bunker gratings and Bunker monorails shall be supplied by BHEL. 3. Tripper floor elevation shall be **EI+56.7m**. Refer bunker sizing details enclosed along with flow diagram. 4. For distance of CHP TP to 1st column of mill bunkers, refer keyplan of boilers enclosed along with flow diagram.
2	Complete auxiliary systems for above mentioned systems (CHP) like Dust Extraction system, Dust suppression system, Air conditioning, Ventilation, Service water, Potable water, Zero Liquid Discharge System, sump pumps (as applicable) etc.as per descriptions given in DVC/NTPC tender specifications (Document no. DVC/C&M/Engineering/RTPS Ph-II/EPC/SG), BHEL technical enquiry specification and subsequent amendments & clarifications, if any till placement of order.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	**1. Coal handling plant area's wash/plant water to be terminated upto Employer's (DVC) proposed CSSP to be terminated upto Ash Slurry Sump/tank or Employer's (DVC) proposed CSSP/ LETP/ WSWS** with all necessary piping fittings, hume pipes, pedestals, pipe racks (as applicable), wrapping coating etc . **2. Tapping point terminals for Service water:** **a: Terminal point-1:** 45 CMH @ Pr. of 15 MWC within 5 m of CHP pump house near TP-17. **3. Tapping point terminals for Potable water:** **a: Terminal point-1:** 8 CMH @ Pr. of 15 MWC within 5 m of CHP Pump house near TP-17.	Coal Flow Diagram for CHP System demarcating terminal points is enclosed.
C	**COMMON FOR AHP, CHP, BMHP, MRHS**								
1	3D modelling for AHP, CHP, BMHP, MRHS Rev-01	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	Complete AHP, CHP, BMHP model including Civil, structural, mechanical, electrical, C&I in E3D software All Structures- RC & Steel Structure in Tekla	
2	Fire fighting System for AHP, CHP Rev-01	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	1. The Fire Protection System including the FDA and Spray System for the AHP, CHP and MRHS area shall be supplied erected and commissioned by the EPC- Vendor 2. Necessary inputs shall be exchanged between the PESD and EPC vendor during the detailed engineering stage. 3. Necessary hook up linkage to the main plant (if required) shall be done by EPC-vendor. 4. EPC Package vendors can take tap-offs from the fire water lines run by PE&SD in BTG area, as required by them, by suitable arrangement. Package vendors to boost the fire water, if pressure furnished by PE&SD is not adequate, by their own booster pumps.	
5	Road & drains	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		The scope of road & drain shall cover for the entire buildings/facilities and Drainage system shall be designed considering the drainage network of entire plant.Scope of road work include giving acess to all facilities covered under AHP,CHP scope from road which is being executed by BHEL.
7	Detailed Geotechnical Investigation.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		Attached
8	Topographical Survey.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		Following Drawings are attached for refrence. A) PE-DG-528-601-C004-TOPOGRAPHICAL SURVEY OF PLANT AREA-SPOT LEVELS WITH EXISTING FEATURES. B) PE-DG-528-601-C003-R0-TOPOGRAPHICAL SURVEY OF PLANT AREA-CONTOURS WITH EXISTING FEATURES)
9	Site clearance including cutting of trees of girth less than 30 centimeters. Cutting of trees of girth more than 30cm shall be done by the Owner, however, removal and disposal of roots, trees of girth less than 30cm and other vegetation is in Bidder's scope.	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		
10	Levelling and grading	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		Micro grading (+/- 500mm) shall be in vendor scope

2x660 MW DVC RAGHUNATHPUR TPS PHASE-II, STEAM GENERATOR (SG) ISLAND PACKAGE

Scope Matrix & terminal points for AHP & CHP EPC package

BROAD SCOPE: The scope for complete Ash handling system and Coal Handling Systems shall include complete design, engineering, manufacture, fabrication, assembly, testing & inspection at manufacturer's works, painting, supply, packing, despatch, transportation, delivery to site, receipt,unloading, intra site handling & storage at site, construction of Stores at site (Open & Closed), round the clock security at open storage yard , closed storage shed & erected material till completion of work, construction, erection, its supervision,statutory requirement (if any), testing ,inspection, commissioning, performance guarantee test and handing over to Owner, including all associated Mechanical, Electrical, Control &Instrumentation works, all auxiliary systems, Civil & Structural steel works, Architectural works, maintenance tools & tackles, mandatory spares, start-up and commissioning spares, lubricants & consumables as specified in tender specification, amendments & agreements till placement of order & as necessary for completeness in all respects and for efficient & trouble free operation for 2X660 MW DVC Raghunathpur TPS Phase-II.

Sl. No./ Chapter	Description	SCOPE IN AGENCY (EPC PKG VENDOR/BHEL)	Broad Scope	DETAIL SCOPE				Terminal Points Description	Remarks
				DESIGN / ENGG	CIVIL/ STR/ ARCH (SUPPLY & ERECTION / EXECUTION)	SUPPLY & ERECTION (MECH, ELEC, C&I)	TESTING / COMMISIONING		
11	Sewarage system	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		Sewarage network/system shall be developed for CHP & AHP and MRHS buildings by EPC package vendor, including construction of Manholes/Collection pits/Lifting pits and under ground piping network from buildings to the Collection pits/Lifting pits. Scoope also includes Pump supporting and handling structures (Monorail structure) at Collection/Lifting pits. Execution of collection pit is in the scope of bidder.
14	Dismantling of any exisiting structures/buildings for execution of AHP, CHP MRHS facilities	EPC PKG VENDOR	Complete Pkg on EPC Basis	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		
D	**MILL REJECT HANLDING SYSTEM SYSTEM**								
1	Complete Mill Reject handling plant as per descriptions given in NIT specification (DVC bidding document No.: DVC/C&M/Engineering/ RTPS Ph-II/EPC/SG), BHEL technical enquiry specification and subsequent amendments, clarifications if any till placement of order.	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR	EPC PKG VENDOR		

Note 1 : Necessary input drawings for BTG areas shall be provided to EPC Vendor.
Note 2 :The above list is not exhaustive. In case of any ambiguity, bidder may note that all the work associated with completeness of AHP,CHP and MRHS shall be in EPC vendor's scope.
Note 3: Interconnection/termination/jointing of various equipment/systems/pipes at all above mentioned terminal points shall be in the scope of EPC Vendor unless specified elsewhere in the tender document.

Corrigendum - 2 dated 19/12/2025 to CPC Tender No. BHEL/CPC/ RTP/EPC_AHP_CHP/26/051

Sub-section-A-14

SUB-SECTION–A-14

WATER TREATMENT PLANT

WATER TREATMENT PLANT

1.00.0**0** **General**

This Chapter describes the system description, minimum Technical Requirements of the Water Treatment plant and associated equipment. The minimum technical requirements for plant and equipment shall include, but not be limited to the following:

1.01.00 **System description**

1) The Pre-treatment plant would be designed to remove suspended/colloidal matter in the raw water. Pre-treatment plant shall be provided for Circulating water system (PT-CW System) and Demineralized water system (PT-DM system). The plant shall consist of clarifiers for PT-CW & PT-DM system. The clarified water shall be used as make-up to CW system either by pumping or by gravity. Clarified water makeup shall be used for various systems like Air conditioning & ventilation system, FGD system, Service water etc. and any other system as envisaged by the bidder in design. CW blow down water shall be used for Ash handling system, FGD system and any other system as envisaged by the bidder in design. Service water provision for CHP dust suppression system shall also be kept. Gravity Filters shall be envisaged for DM and Potable water system. The filtered water shall be used in DM plant to produce demineralized water of specified quality. A common chemical house shall be provided to store chemicals, dosing equipment etc. Chemical house and Filter house shall be RCC buildings.

2) Chlorine di-oxide plant for CW system (CW-ClO_2) & PT system (PT-ClO_2) shall be installed in a common location/building if layout permits. Chlorine di-oxide shall be generated at site (in situ safe generation that takes place completely in water) from Acid-Chlorite process using 33% commercial grade HCl and 31% Sodium Chlorite ($NaClO_2$) solution in presence of motive water. Bulk storage tanks for $NaClO_2$ shall be kept under shed. Neutralization system shall be provided for the ClO_2 plant(s) to neutralize chemicals from the plant. The Chlorine di-oxide plant shall be installed in RCC building.

3) The contractor shall provide either Ion exchange-based DM plant or RO based DM plant. The capacity of DM plant either by Ion exchange process or RO process shall be sized to meet the makeup water requirement of the steam cycle, make up water to close circuit equipment cooling water (ECW) system, stator water cooling system etc. and any other requirements as envisaged by the Contractor. Reject from RO plant shall be recycled and reused in coal handling plant suitably. DM Plant (either by Ion exchange process or RO process) shall be kept under steel shed open from side. DM plant regeneration area shall be kept under steel shed. Pump houses shall be envisaged under steel shed unless otherwise specified.

4) Wastewater Treatment System & ZLD: An effluent management scheme for the plant consisting of collection, treatment, maximum recycle & reuse shall be adopted by the contractor to optimize the make-up water requirement and minimizing various plant effluent water, and for meeting and maintaining the Zero-liquid discharge (ZLD) of the plant. The contractor shall provide a detailed scheme and write-up for the Zero liquid discharge to be envisaged for the plant during detailed engg. The minimum technical requirements shall include, but not be limited to the following:

   a) Treating the service water effluents from various plant areas in ETP and treated service water from Treated Water Tank/CMB used for recycling/re-use in plant. The filter backwash water to be recycled back to the CW Clarifier. The filter backwash water of DM Plant to be recycled DM Clarifier. The effluent waste from DM Plant/ClO_2 plant etc. to be neutralized and pumped to Ash slurry sump/tank. Power cycle blow down shall be recycled to condenser with provision for recycling the same to the CW system with suitable quenching arrangement.

   b) Coal laden water in the plant shall be treated in settling ponds and decanted water recycled/reused in Coal handling plant suitably. Coal settling ponds and treatment plant shall be designed suitably to receive and treat excess storm water

mixed with coal laden water and supernatant water recycled to CW channel, with provision for diverting the treated supernatant water to storm water drain & Waste service water to be treated in ETP. Lime, alum, and suitable synthetic flocculent dosing to be envisaged to increase the settling rate of suspended solids.The pH of treated supernatant water is expected to be acidic in nature (pH: 2.8-7.8) and required to be neutralized prior to discharge in CW channel, storm water drain & ETP with required lime dosing facilities. The clarifier sludge shall be dewatered using the Filter press for dried coal particles to be reused.

c) Excess AWRS water, if any after use in Ash Handling System, shall be taken in WSWS system and suitably treated for recycle and re-use in Service water/ CHP dust suppression etc. to ensure ZLD.

Minimum requirements of the Employer, and the equipment, and systems for the ZLD system are specified in various parts of the specification, which shall in no way relieve the Contractor of his responsibilities to meet all ZLD compliance of the plant.

2.00.00 General design requirement of PT systems

1) The hydraulic circuit of the complete Pre-treatment plant shall be designed in such a way that Water from aerator shall flow by gravity up to the clarified water storage tank (for PT-CW) and Filtered Water sump (for PT–DM & PT-Potable) under various flow rates up to maximum flow. The system shall be designed with Top water level in the Clarified water storage tank as (+) 4.5 M from the FGL or higher. Maximum water level in the filtered water reservoirs shall not exceed the local FGL. Hydraulics of the Complete PT system shall be designed to take an occasional over loading of 20% over the design flow.

2) All the clarifiers shall be designed to operate simultaneously. PT plant shall be designed such that following units can be bypassed if required a) Any one clarifier/two clarifiers/all clarifiers of PT-CW system b) Clarifier PT-DM system c) Interconnection of Clarifiers of various system(s)

3) Pre-treatment Plant should be designed to run continuously.

4) The various units of PT plant like Aerator, Stilling chambers, Clarifiers, inlet channels, Chemical house first floor, Gravity filter operating floor, Clarified water tank etc. shall be interconnected by at least 1 M wide walkway at appropriate elevations with hand-railing on both sides and pathway at ground level as required by Employer.

5) Raw water temperature varies seasonally from 10 deg C to 36 deg C.

6) Cascade aerators shall be designed based on the surface flow rate of not less than 0.03 m2/m3/hr. The velocity of water rise through the stilling chamber shall be 0.05 m/sec and volume of stilling chamber shall have a retention time of 1 minute.

7) The Chemical unloading pumps area shall be provided with a kerb wall and the kerbed area shall also be provided with Acid proof lining. Suitable dyke wall/barrier shall also be given in between chemical tanks to avoid any kind of mixing.

2.01.00 **Reactor Clarifier unit**

1) The unit shall be designed with a minimum retention time of 90 minutes in the settling zone. Larger retention time may be provided to meet the equipment guarantee.

2) The overall area of the unit shall be based on an average flow velocity not more than 3 m3/m2/hr. Weir loading shall not exceed 300 m3/m/day. For uniform overflow over weirs, triangular notches (saw tooth weir) shall be provided as necessary.

3) Clear width of the bridge shall not be less than 1200 mm. All the Reactor Clarifiers shall be equipped with full bridge.

4) Design of the sludge removal system should be such as to reduce loss of water during sludge blow off within 3% of rated flow.

5) The clarifier periphery (all around) shall have sufficient width (minimum 850 mm) to have an easy walkway for general inspection. The walkway shall be provided with handrails along with periphery access (staircase) at least from two (2) locations with platforms and hand railing for the clarifiers for good approach. Permanent ladder shall also be provided (not rungs) for approaching the sludge pipeline valves for maintenance.

6) The sludge valves shall be operatable from the top of the sludge chamber through head stock and extended spindle arrangement.

2.02.00 **Chemical House**

1) The storage rooms shall have suitable bins/partitions sufficiently large to accommodate for lime and alum. The chemical house shall have sufficient unloading space, wide corridors for movement of chemicals, office, toilet etc. as required.

2) In the first floor of chemical house, all chemical preparation tanks and dosing equipment shall be located. Suitable staircases, walkways, platforms etc. shall be provided to have clear access to different units.

3) Quick lime (purity of 75% CaO) shall be dissolved in the slaking tanks and the resultant slurry (about 10% W/V) from the slaking tanks shall be transferred to the lime solution preparation tanks by the lime slurry transfer pumps. The lime solution dosing system shall be of re-circulating type.

4) Alum solution preparation tanks and dosing equipment shall be sized for a continuous alum dosage of 70 ppm considering the clarifiers to be operating at the maximum capacity.

5) Operating platforms shall be provided for all the structures such as Aerators, Stilling chambers, Clarifiers, Sludge chamber etc. along with step ladders and hand railings. All the sumps, tanks, reservoirs, and other water retaining structures shall be provided with approach ladders (i.e. step ladders with hand railing) from operating platforms/ground level.

6) All the metallic parts of equipment of Pre-treatment plant (PT) and effluent treatment plant (ETP) which are embedded in concrete or in contact with water shall be painted with three coats of bitumastic heavy duty paint over a coat of primer to prevent corrosion unless otherwise specified and total thickness shall be 400 microns.

7) All the other parts of the PT Plant and ETP shall be painted with one coat of primer and three coats of chlorinated rubber paint and total thickness shall be 200 microns. The concrete parts encountering water shall be painted with three (3) coats of bitumastic heavy-duty paint of 400 microns thick.

8) All the tanks shall be provided with vent, overflow, drain and sample connections. Effective capacity for chemical tanks & water retaining structures/ tanks/sumps means the capacity between the bottoms of the overflow nozzle to the top of the outlet nozzle. Outlet nozzle center line shall be kept at least 200 mm from the Invert Level of the Chemical tanks /Water retaining structures /Tanks/Sumps. A minimum free board of 300 mm shall be provided in all the water retaining structures of Pre-treatment plant and Effluent treatment plant above the maximum water level at design flow condition/overflow level.

9) Maximum operating speed of all the pumps shall be limited to 1500 rpm or less unless specified otherwise.

10) Various equipment in the PT Plant will be sized for the following minimum Chemical Dosing Requirements:

a)	Alum	70 mg/litre on 100% basis
b)	Lime	30 mg/litre on 100% basis

11) For all pumps, while calculating the pump head, 10% margin shall be considered on friction losses.

12) The maximum support length in meters for MS pipe shall be as follows

a)	Pipe dia (mm)	1200	1000	800
b)	Span (meters)	12	10	10
For pipe sizes less than 800 NB, span shall be provided as per ANSI B31.1				

2.03.00 **Gravity filter**

1) The inlet channel from clarifiers to gravity filters shall be designed considering operation of all the gravity filters including standby filters under exigency.

2) Only one filter shall be backwashed at a time. Backwashing of filters shall be done in not less than 24 hours. The velocity of water during backwashing shall not exceed 35.0 m/hr., when air scouring is employed. Air blower shall be used for air scouring of filter bed.

3) At least 50% free board shall be left over the filtering media to facilitate backwashing. The filtering medium shall be washed, screened, and hydraulically graded anthracite coal or sand having an aggregated depth not less than 1200 mm.

4) Anthracite shall have the following properties: -

Uniformity coefficient	1.6
Hardness	2.5 to 3.5 (Mho scale)
Dust content	Less than 1%
Specific gravity	1.75 (Approx.)

Anthracite shall be free from iron sulfide, clay, shale, long, thin or scale pieces

5) Sand shall have the following properties: -

Sand shall be of hard and resistant quartz or quartzite and free of clay particles, soft grains, and dirt. Effective size shall be 0.45 to 0.70 mm. Uniformity coefficient shall not be more than 1.7 or less than 1.3. Ignition loss should not exceed 0.7 per cent by weight. Soluble fraction in hydrochloric acid shall not exceed 5.0% by weight. Silica content should not be less than 90%. Wearing loss shall not exceed 3%. Specific gravity shall be in the range between 2.55 to 2.65.

Sand should be clean and well graded. Sand filter shall have a HCL solubility of less than 5% when tested in accordance with AWWA B 11.53.

3.00.00 Other design and construction features

3.01.00 **Aerator & Stilling Chamber**

The aerator shall be of stepped design and shall allow water to flow downward after spreading over inclined thin sheets and the turbulence is secured by allowing the water to pass through a series of steps and baffles. The chlorine di-oxide dosing shall be done in the stilling chamber before and after aerator by using diffusers of proven design.

3.02.00 **Clarifiers**

3.02.01 The clarifier shall be solid contact reactor type with integral variable speed impeller/ turbine to internally re-circulate water and sludge at adjustable rate to produce consistent water quality at varying hydraulic load and turbidity.

3.02.02 The Clarifiers shall be provided with following features:

1) The sludge blanket shall be suspended and maintained in the lower portion. The clarifier unit shall be circular, central feed type with concentric recirculation zone (rapid mixing), reaction zone (slow mixing) and clarification zone in RCC construction. Clarifiers shall be provided with radial launders.

2) Bridge type rake arm and suitable equipment such as turbine/ impeller shall be provided for internal sludge recirculation.

3) The design of the turbine/impeller shall be such as not to break the flocs during recirculation.

4) Suitable mechanism for varying the recirculation rate shall also be provided such that the reactor clarifier shall be capable of operating at varying hydraulic load and turbidity with consistent effluent quality.

5) The bottom of clarifier shall be sloped towards the center and mechanically driven sludge scraper and collector shall be used to remove the settled sludge down the sloping bottom to the central sludge area. Rubber squeezer pads shall be provided on sludge scraper and skimmer.

6) Sludge removal system design shall consist of central sludge area with rotating pickets and back flush arrangement for proper control of sludge accumulation at the bottom. Suitable scum collecting arrangement shall be provided in the clarifying section for removal of floating debris, foam etc. if possible. The scrapper shall consist of blades which are inclined to the radius in the opposite direction to that of the floor scrapper.

7) The rake bridge and agitators shall be constructed of structural steel and suitably braced to provide rigidity.

8) Sludge blow off shall be affected by the static head of water in the clarifier unit. Main sludge disposal line, which includes a blow-off valve, shall drain sludge to the sludge disposal pump sump. This is an intermittent operation. Continuous sludge disposal line consists of telescopic standpipe, the top of which is maintained at a desired elevation to ensure trickle flow of water or sludge water mixture to the sludge sump.

9) Suitable sampling connections from the various levels and zones of clarifier and at the outlet shall be provided for performance monitoring.

10) Each of the clarifier shall be provided with a gate at the outlet for isolation of any of the clarifier for maintenance.

3.03.00 **Filters back washing**

1) Filter Box shall be of watertight RCC structure. Gravity Filters of Potable Water System & DM System shall be covered with RCC roof.

2) The capacity of the overhead filtered water tank shall meet the backwash flow rate for simultaneous backwash of one (1) number of gravity filter (both the sections) each of Potable System and DM system.

3) The inlet distribution shall be designed to give uniform distribution and flow without channeling and obstruction. Proven type under drain collecting system provided.

4) Each filter bed outlet shall be provided with rate of flow controller and rate of flow indicator and a loss of head gauge. The manual extension spindles of all the valves of filters shall be operatable from the operating floor of filter bed. Each of the Gravity filter shall be provided with drain connections with isolating valves for draining complete filter water channel and filter bed.

5) Platform over each of the gravity filters with hand railing shall be provided for the inspection of backwashing operation and filter bed. These platforms shall be approachable from the operating floor of gravity filters through doors.

6) Only valves shall be used for different process of filters. Suitable sampling point with sample valve shall be provided at the effluent of each filter.

3.04.00 **Filtered Water Sumps**

Filtered water from the two (2) sections of the filtered water reservoir shall enter the sump through two (2) numbers of isolation valves.

3.05.00 **Overhead Filtered Water Storage Tank**

The overhead tank shall have approach from chemical house through permanent staircases (RCC) and door.

3.06.00 **Overflow & drain disposal system**

The overflow & drains from the various chemical tanks and floor wash drains shall be led to the PT Plant clarifier sludge sump. The overflow & drains from structures and piping handling clear raw water, clarified water and filtered water in the Pre-treatment plant such as Stilling chamber, Inlet chamber shall be led to the filter backwash sump. The overflow & drains from the filtered water reservoir, filtered water sump etc. shall be led to the filter backwash sump. Overflow from filtered water overhead tank shall be led to the inlet channel of Gravity Filters of PT-DM. Concrete sewerage pipe/Hume pipe shall not be used for any of the drain disposal system.

3.07.00 **PT Plant Clarifier sludge disposal system**

One (1) number sludge pit, in twin sections shall be provided to collect the sludge from all the clarifiers/tube settlers/lamella periodically. The sludge shall be transferred to the ash slurry tank/sump by means of sludge transfer pumps. Each section of the pit shall be provided with agitation by recirculation (jetting nozzles) system and air agitation system. Two (2) numbers air blowers shall be used for the air agitation system of the sludge pit.

3.08.0 **Filter Backwash Water Disposal System**

Filter backwash water shall be led to a separate sump (twin section). Each section of the sump shall be provided with agitation by recirculation (jetting nozzles) system and air agitation system. Air blower shall be used for the air agitation system of the sump.

3.09.00 **Clarified Water/Other Storage Tanks**

The water tank shall be provided with access rungs and dewatering pits.

3.10.00 **Waste Service Water Treatment System**

Hydraulics of the plant shall be such as to take an occasional overloading of 20% of the design flow rate.

a) **Design Conditions for tube settlers/lamella clarifiers:**

		Inlet quality	Outlet quality
i)	Turbidity	500 NTU (max)	10 NTU (max)
ii)	Oil content	50 ppm (max)	5 ppm (max)

b) **Wastewater collection Sump & Pumping scheme**

1) Service water effluents (after floor washing etc.), other plant effluents etc. having high-suspended solids require treatment for removal of total suspended solids (TSS).

2) The minimum technical requirements for waste service water system (WSWS) shall include, but not be limited to:

a) Collection sump(s) in different areas/clusters,
b) Waste service water sump (WSWS)
c) Tube settlers/Lamella clarifiers (2x100%)
d) Oil skimmer (2x100%) Oil centrifuge (2x100%)
e) Pumps, (n+1)

f) Chemical storage, handling, and dosing equipment etc.

3) The treated water shall be reused/recycled suitably in plant like in service water etc. A Waste service water sump (WSWS) shall be provided for collection of service water effluents from various areas/clusters. Waste service water transfer pumps shall be installed in WSWS to pump waste service water to Tube settlers/Lamella clarifiers.

4) Chemical dosing (Alum & lime) shall be provided for these Tube settlers/Lamella clarifiers in the chemical house.

5) The treated water form Tube settlers/Lamella clarifiers shall be led to Treated water tank/Central monitoring basin (CMB) of twin sections of RCC construction. Provision for diverting clarified water to service water tank shall be provided. Capacity of each section shall be suitable for storing 60 minutes of discharge from one Tube settler/lamella clarifier. Service water transfer pumps shall be provided for plant service water network etc.

6) Oil skimmer(s) shall be provided in the waste service water sump so that oil impurities floating on the sump is skimmed and collected in a tank located over ground. Facility shall be provided to collect free oil to a MS oil drums of 200 liters capacity. Trolley mounted oil centrifuge of suitable capacity shall be provided to collect and purify the oil of the Waste Service Water System.

c) **Tube Settler/Lamella Clarifier**

1) The tube settler/Lamella Clarifier (counter flow or cross flow type) with flash mixer and Flocculation Chamber at its upstream (all RCC), with minimum 1-minute storage for flash mixer and 10-minute storage for flocculation chamber at the design flow rate. Design of the sludge removal system should be such as to reduce loss of water during sludge blow off within 5% of rated flow. Design flow velocity shall be not more than 5 $m^3/hr/m^2$. Minimum side water depth of the unit is 4 M.

2) The cross-sectional area of each tube shall be such that the effective hydraulic diameter is 60 mm (min). The material of tube pack shall be UV inhibited virgin PVC. In case of plate type separator, the plates shall be made of GRP (glass reinforced plastic). The resin for the manufacturing of GRP plates shall be orthophthallic type.

3) The length of the tubes/plates through which the water flow shall not be less than 1.5 m, the tubes/plates shall be inclined by 50-80 deg. angle to the horizontal.

4) Sludge removal system shall be designed to thicken the sludge to minimum 2% consistency before disposing from separator bottom, angle of inclination of sludge hopper shall be minimum 55^o to horizontal plane.

5) Walkway (bridge) and platform to approach all the internals shall be provided. Clear width of the bridge shall not be less than 1200 mm. Suitable walkway around periphery of tube settler/clarifier with hand-railing, access ladder with platform, hand railing to be provided. Suitable water jet arrangement shall be provided. All the pipelines carrying the sludge shall be provided with flushing connection. Separate pumps and piping shall be provided.

3.11.00 **Coal Handling Plant Run-Off Water Treatment System**

1) The settling ponds shall be designed to take care of flow conditions which may occur during the rainstorm. Interconnection shall be provided between the ponds such that flexibility of selecting any pond remains.

2) The exit for run-off water from the settling pond shall be such that the short-circuiting of water is avoided. For this purpose, water shall be allowed to traverse under a breast wall located about 5 meters ahead of outlet side of the pond.

3) Runoff water from coal slurry settling pond would be led to a sump and pumped (2x100%) for re-use in Coal handling plant and as well as treated in clarifier (1x100%)

for recycle/reuse in CW system. Provision for diverting treated supernatant water to storm water drain & WSWS with pumps (2x100%) and isolating valves in the lines.

4) Adequate steps/stairs to be provided in coal settling pond for manual cleaning of pond.

4.00.0 Demineralisation plant (DM plant) ((Option I)

The minimum technical requirements equipment shall include, but not be limited to the following:

4.01.0 General requirement

1) All the vessel internals of activated carbon filters, Ion-exchanges units, and degasser units such as inlet distributor, regenerant distributor, under drain system etc. shall be of proven design.
2) All valves used with vessels shall be suitably arranged in the front in accessible position, for manual operation in case of emergency. The valves under automatic operation of DM Plant shall be operated pneumatically by diaphragm actuator.
3) All dematerializing streams shall be designed to run continuously at its rated capacity and simultaneously under parallel operations.
4) Suitable permanent flushing connections shall be provided for all pipelines carrying acid and alkali.
5) The pipelines which are immersed inside the drain trench or in Neutralization pits shall be rubber lined to a height of at least 600 mm from the maximum liquid level apart from internal rubber lining.
6) All the external parts of equipment of complete DM Plant shall be painted chlorinated rubber paint unless specified otherwise.
7) The unloading pumps area shall be provided with a kerb wall and the kerbed area shall also be provided with Acid proof lining. Suitable dyke wall/barrier shall also be given in between chemical tanks to avoid any kind of mixing.
8) Suitable sampling points shall be provided for ACF, all Ion exchange units of DM plant.

5.00.00 Design and construction features

5.01.00 **Activated Carbon Filters (ACF)**

1) Design and Fabrication of the vessel should be according to subsection titled “Pressure & Storage vessel” of Part-B of this Technical Specification.
2) The activated carbon shall be of good quality suitable for removal of odor, chlorine, and dissolved organic substances.
3) Suitable (at least 75%) free board shall be provided over the filtering medium below the backwash outlet nozzle and in straight portion of vessel to facilitate backwashing.
4) The inlet distribution (preferably header-lateral type) and under drain collecting system (header-lateral/strainer-on-plate) shall be so designed as to give uniform distribution and flow without channeling and obstruction.

5.02.00 **Ion Exchange Units**

1) Design and Fabrication of the vessels should be according subsection titled “Pressure & Storage vessel” of Part-B of this Technical Specification.

2) Under drainage system shall be header lateral or strainer-on-plate type. The inlet distribution system shall preferably be header lateral type. Material of construction shall be mild steel with rubber lining (MSRL) and rubber covered (RC).

3) The regenerant distributor and middle collector shall be mild steel rubber lined inside and rubber covered outside. All internal studs /nuts/washers shall be of AISI 304 L for alkali service and of suitable MOC for acid service.

4) At least 100% free board shall be provided over resin bed below the backwash outlet nozzle and in straight portion of vessel to allow for expansion during backwashing and for addition of extra resin, if required.

5) All the Ion Exchangers shall be provided with two additional nozzles for hydraulic transfer of resin as and when necessity arises. The nozzle shall be provided with manual valves of 100 mm NB.

6) Each exchanger unit shall be provided with resin traps on treated water outlet line. Resin traps shall also be provided both on the backwash and regenerant outlet lines. Flow measuring instrument shall also be provided at the regenerate outlet of preceding unit in case of thorough fare regeneration.

5.02.01 <u>Surface Flow Rate for Ion –exchangers</u>

1) The following shall be maximum surface flow rates for the various Ion-Exchangers at the design capacity.

   i) Cation unit – 35 $m^3/hr/m^2$ (for both weak and strong Cation)
   ii) Anion unit – 35 m^3 hr m^2 (for both weak and strong Anion)
   iii) Mixed bed unit – 40 $m^3/hr/m^2$.

2) In case of both weak and strong Ion-exchange units (for Cation and/or Anion unit), the surface flow rate for the strong ion exchange unit(s) only may be increased as indicated below, in case the bidder/its sub-vendor has adequate experience of designing Demineralisation plants of such higher surface flow rate:

   Maximum surface flow rate: -

   i) Strong Cation unit – 40$m^3/hr/m^2$.
   ii) Strong Anion unit – 40 $m^3/hr/m^2$.

5.03.0 Regeneration System

1) The ion exchange resin shall be regenerated by employing optimum regeneration level to prevent leakage of ions. Cation resins shall be regenerated by hydrochloric acid (30-33% w/v technical grade IS:265) and anion resins by sodium hydroxide (48% w/v rayon grade in flakes or lye form as per IS:252).

2) Regeneration system should be designed such that AC filter, cation, anion, and mixed bed units of a particular stream can be regenerated simultaneously/separately at a time.

3) For calculation of anion capacity and silica leakage the temperature of alkali regenerant shall be taken as 25 deg.C.

4) Bidder/its sub-vendor shall adopt co-current or counter-current regeneration technique provided the same technique of regeneration were adopted in the plants by him by virtue of which he is qualified to participate in this bid. The guaranteed chemical consumption figures must be supported by relevant published data such as performance of the resin system and/or actual field performances of plants using a similar technique, indicating

the quantity of chemicals required for regeneration, in particular, besides other parameters.

5) The process calculation shall be furnished by the bidder indicating the various steps of regeneration, regeneration level employed, total and used exchange capacity of resins in various exchangers, resin quantity provided in ion exchange vessel etc. The bidder shall furnish relevant resin literature & curves indicating various parameters and exchange capacity & regeneration levels selected along with the process calculations.

6) The process calculation along with the operating exchange capacity and regeneration levels vetted by resin manufacturer and the resin performance curves especially applicable for this plant shall also be submitted during detailed engg.

7) Regeneration facilities offered shall be complete with acid/alkali measuring tanks, ejectors for dosing of chemicals. Alkali flakes shall be used for preparing alkali solution of adequate strength in the preparation tanks. Acid or alkali from the measuring tank, shall be injected to exchangers by means of hydraulically operated ejector or metering pumps at suitable strength.

8) Separate acid measuring tank and ejector (one each) shall be provided for cation & MB and separate alkali measuring tank and ejector (one each) for anion & MB shall be provided. Suitable inter connection of dosing system shall be provided for flexibility of operation.

9) Automatic block and bleed valves shall be provided at the regenerant inlet line(s) to each exchanger of Strong Acid (SAC) Cation, Strong Basic (SBA) Cation & Mixed (MB) Bed.

10) Suitable sampling connection shall be provided for acid/ alkali storage, preparation & handling equipment.

5.04.00 **Alkali Diluent Water Heater.**

For heating of alkali diluent water, 2x50% electrical heating coil in a tank of mild steel rubber lined construction shall be provided. The tank shall be sized based on 125% of the regeneration water requirement of one anion and one mixed bed (effective Capacity 10 cum (minimum). The tank shall be provided with burn out protection, pressure relief valve, temperature indicator, etc. The heater shall be controlled by the temperature switches provided on the tank. All tank internals, including the inlet water tail pipe shall be rubber lined inside and rubber covered outside or of SS-304 stainless steel.

5.05.00 **Exchange Resin**

1) Cation and anion resin shall be of reputed make and proven type and must have been in use in demineralising plants capable of producing water of quality as specified or better, for a period of not less than three (3) years.

2) Cation and anion resin charge shall consist of material properly selected washed, processed and graded to provide the guaranteed capacity and life and shall have adequate abrasion resistance during its guaranteed life.

3) The cation exchanger resin used in the strong cation unit and mixed bed exchanger shall be strongly acidic, high capacity polystyrene resin in the bead form.

4) The anion exchanger resin used in strong anion unit & mixed bed shall be strongly basic, high capacity resin (Type-I) in bead form to the satisfaction of the Engineer. The anion resin shall be able to withstand a temperature of 60 deg. C (minimum) continuously. Type-II anion resin shall not be accepted. Strong Base Anion resin (or weak base Anion in case of hookup) shall be MACROPOROUS type only.

5) Each stream shall be provided with independent headers from the outlet of Activated carbon filters. However, suitable inter-connecting lines, valves shall be provided at outlet/inlet of each unit to facilitate the changeover.

6) Bidder shall design the DM water chains in such a way that any chain can be regenerated without the necessity of other chain being put into operation.

5.06.00 **Degasser System**

Degasser tower shall be designed to reduce dissolved CO_2 in treated water to the level as indicated in the guarantees. Blowers shall be provided to remove CO_2 from water. Each tower shall be provided with a storage tank to store degassed water.

5.07.00 Polishing UF

Commercially proven hollow-fiber, high volume pressurized type UF membranes of Polysulfone, Poly Vinylidene Di Fluoride (PVDF) shall be supplied. Gross maximum design flux rate shall not be more than 60 l/m^2/h. Filtration direction may be either Out-to-In or In-to-Out. Minimum design UF recovery shall be at least 92% of the influent with a colloidal silica rejection of not less than 99.5%. Maximum Membrane pore size shall be 10000 Dalton MWCO (Molecular weight cut off).

5.08.0 Safety and Protection

Automatic safety shower units consisting drench shower and eye bath shall be provided near regeneration area & chemical storage area to provide adequate spray of water to protect operating personnel against any chemical hazard.

The shower shall receive supply of water from the filtered water system and will be actuated by standing on platform beneath the showers through mechanical linkage.

5.09.00 **Wastewater Neutralizing Arrangement**

Bidder shall design the demineralising plant in such a way that the regenerant effluent from cation and anion units and from the mixed bed unit are self neutralising. Provision shall however be made to dose acid, alkali, and lime to neutralise the effluent, whenever required.

5.09.01 **Sump & Trenches of wastewater**

Wastewater from all vessels namely Activated Carbon Filter, Cation, Anion and Mixed Bed exchangers will be led into individual sumps near each vessel. Bidder shall provide measuring orifice board into the sump. Wastewater after being metered through the orifice board, will be led by gravity into trench, suitably lined and finally to the neutralising pit. The backwash wastewater from Activated Carbon Filters and Rinse wastewater generated during regeneration of the DM stream shall be routed through separate effluent channel (acid/alkali proof tile lined) and shall be terminated in Backwash/ Rinse Wastewater sump. The Backwash/ Rinse Wastewater sump shall be lined with acid/alkali proof tile. The backwash water recycling/reused in Clarifier of Pre-treatment Plant.

5.09.02 **Waste Neutralising Pits**

One (1) number RCC pit in twin compartment design shall be provided. Suitable baffles shall be installed in the pits/effluent trench to mix the wastes during their passage to neutralise the effluent. Suitable priming chamber shall be provided in case horizontal pumps are offered. Chemical (Acid/Alkali) lines from bulk storage tanks (acid) & alkali preparation tanks shall be routed and terminated to neutralising pits. Provision shall be made to dose lime solution in the neutralising pit. Suitable proven agitation system (e.g. air agitation/venturi mixing etc.) shall be

provided for proper mixing and maintaining uniform pH value of the wastewater in addition to recirculation system.

5.09.05 **Filter Back Washing**

Backwashing of filters shall be done once in 24 hours. The inlet distribution and under drain collecting system shall be so designed as to give uniform distribution and flow without channeling and obstruction. The under-drain system may either be of header lateral or manufacturer's standard design.

5.10.00 Pressure Filter Design features

Pressure filters shall be designed for surface flow rate. Design and Fabrication of the vessel should be according to subsection titled "Pressure & Storage vessel" of Part-B of this Technical Specification.

1) Maximum velocity of filtration shall be 10 m/hr. at design capacity and velocity during backwashing shall not exceed 35.0 m /hr. when air scouring is employed.
2) Air blowers (2x100%) shall be used for air scouring of filter bed. The filter shall be designed to handle an inlet turbidity of 20 NTU.
3) At least 75% free board shall be left over the filtering media to facilitate backwashing.
4) The total design backwash quantity shall not exceed minimum 2% of the treated water flow over a period of twenty-four hours or between two successive backwashes from each filter.
5) The filtering medium shall be washed, screened, and hydraulically graded anthracite coal or sand having an aggregated depth not less than 1200 mm.
6) Details of layers of pressure filter medium and Anthracite and Sand properties: Refer Gravity filter.

6.00.00 Control & operation of the DM plant

1) The control & operation of various systems described below is indicative only and the actual control & operation philosophy shall be finalized with during detailed engineering based on which the control logic is to be built by the contractor in DDCMIS. Complete DM Plant operation shall be through mimics on OWS/LVS The sequence startup mode (Automatic, semi-automatic and operator guided mode) shall be provided shall be of the following types
2) In case of failure of control system, the DM plant valves shall be operated manually by means of manual operator of solenoid valves (as well as by hand wheel of valves) locally.
3) Acid and alkali unloading pumps, agitators of alkali preparation tanks & day tanks and alkali transfer pumps shall have provisions of local start also.
4) Complete stream shall be isolated automatically from SERVICE in case any of the following take place and an alarm displayed.
5) Differential conductivity of the effluent is less or totalised flow and sodium leakage from the cation is high. Conductivity of the effluent or totalised flows from anion is high. Conductivity or silica content of the effluent or totalised flow from mixed bed is high.
6) The operation of alkali/acid inlet valves at ejectors shall be interlocked with the availability of dilution water in the respective ejectors.
7) Common conductivity meter shall be employed for measuring conductivity in the effluent line and rinse lines for anion and mixed bed exchangers. During rinsing of

anion and mixed bed unit, the respective analyzer shall be connected to rinse line automatically, in the end of the rinse cycle.

8) During rinsing of mixed bed unit, the analyzer of silica shall automatically be connected to the stream which is under regeneration to ascertain the completion of rinsing operation.

9) Only one stream shall be regenerated at a time. However, all the streams can be put to service simultaneously. The alkali diluent heater shall be controlled by measuring the temperature of water in the heater.

10) For all the pumps, blowers etc. which form part of the automatic operation, facilities through control system shall be provided for Auto/remote manual/Local mode selection wherever specified. Wherever standby equipment is provided, selection of the same shall be possible from the control system. The selected standby equipment shall start automatically in case of failure of working equipment. For, other drives which are not involved in continuous running or automatic operation, facilities through control system shall be provided for remote/local selection.

6.01.00 **Backwash pit and pumping scheme**

1) At a specific water level in the sump, selected pump(s) shall start, and backwash wastewater shall be recycled back to the clarifiers. Upon reaching predetermined low level, one of the operating pumps shall be stopped and further reduction in level shall result into stoppage of all the operating pumps.

2) The pit level shall be available to operator and in case of very high level, the operator shall be alerted to avoid starting of backwash/rinse operation so that the pit does not overflow.

6.02.00 **Neutralization pit and pumping scheme**

1) At a specific water level in the sump, selected pump (s) shall start, and backwash wastewater shall be recycled back to the pit and after achieving desired pH level, the wastewater shall be pumped out to Ash slurry sump. Upon reaching predetermined low level, operating pumps shall be stopped and further reduction in level shall result into stoppage of all the operating pumps.

2) The pit(s) level status shall be available to operator and in case of very high level; the operator shall be alerted to avoid starting of regeneration operation so that the pits do not overflow.

DM Plant (Option II)

7.00.00 General

7.01.00 The scope of work covered under this specification include but not limited to design, fabrication, manufacture and assembly, inspection, shop testing at manufacturers works and transportation to site, supply, erection of complete UF-RO Plant, Chemical Storage & Handling etc.

7.02.00 Contractor shall take full responsibility for system sizing based upon actual equipment to be provided. Contractor shall confirm sizing of all systems and components, including, pipes, pumps, and ancillary systems along with relevant calculations. All materials and components of valves, pumps, piping, tanks and other equipment and appurtenances shall be compatible with the respective fluid herein.

7.03.00 Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer as approved by the engineer.

The minimum technical requirements equipment shall include, but not be limited to the following:

8.00.00 Technical requirements

8.01.00 Ultrafiltration (UF)

UF system shall include, but not be limited to the following:

1) UF membrane shall be capable of producing UF permeate by removing colloidal silica level to the extent suitable for downstream reverse osmosis (RO) unit.

2) The system shall be designed to allow multiple starts and stops without affecting the service life of the membranes. The system may experience extended periods of no flow; system design shall protect the system against periods of no flow as recommended by membrane manufacturer.

3) Provisions for local grab sampling points shall be provided to monitor UF performance for UF feed, strainer backwash, UF permeate water, UF backwash, UF neutralized backwash water as a minimum.

4) Each stream/train shall be provided with 1x100% automatic self-cleaning strainers (SS) at inlet with about 100 microns.

5) UF membranes shall be hollow-fiber, pressurized type, MOC Polyvinylidene di fluoride (PVDF). Gross maximum design flux rate shall not be more than 60 $l/m^2/h$. Design UF recovery shall not be less than 92%. Pore size of membrane shall not be more than 0.04 micron. In the event of fiber breakage, the affected module shall be easily identifiable on the Rack through use of clearly visible inspection window built into the filtrate discharge pipe.

6) An on-line membrane flushing system shall be provided to flush the UF membranes prior to shutting down.

7) UF feed pumps and UF backwash pumps shall be provided with variable speed drives (VFD). Capacity of each UF permeate water storage tank shall be sized for minimum one (1) hour retention

8) Spent chemicals from the chemically enhanced backwashing & CIP shall be neutralized in Neutralization pit.

9) Online Turbidity transmitter shall be provided to measure UF filtrate turbidity with high turbidity alarm interlocked to shut down of UF system if high turbidity is sustained for a pre-set time. Automatic on/off valves and filtrate flow transmitters shall be provided to automatically conduct air integrity test of UF membrane modules.

10) Membrane cleaning system shall be provided as per recommendation membrane designer and membrane manufacturer. The cleaning system shall be connected to the UF trains with permanent hard pipes.

11) After the manufacture, following tests for membrane shall be demonstrated at membrane manufacturer's works in the presence of Employer's representative and contractor:

    i). Bubble Point Test in one batch

    ii). Integrity test (Pressure decay test/vacuum hold test) for 1 % of total membrane population.

The responsibility for conducting the test (Bubble Point, Integrity) will be with the Contractor and Contractor shall make all the arrangements for carrying out tests at membrane manufacturer's works. In case the test facilities are not available at manufacturer's works, the test may be carried out at any other test facility with the approval of Employer. The cost associated with testing at contractor's works or at any

other test facility shall be borne by the contractor & shall be included in the contract price.

12) Integrity test shall be carried out in accordance with ASTM D 6908-06, Standard Practice for Integrity Testing of Water Filtration Membrane Systems (Pressure decay test/vacuum hold test) and approved test procedure. Bidder shall submit the test procedure for Employer's approval. Design calculations of Ultra filtration system shall be vetted by membrane manufacturer

8.02.00 **Cartridge filters**

The filter elements shall be cylindrical cartridges constructed from continuously wound polypropylene fibers, which have a 5-micron nominal 90% efficient rating. Polypropylene material shall be 100% polypropylene with no binders, resins lubricants or other residue from the manufacturing process. The filter vessel shall be designed in accordance with ASME boiler and pressure vessel code section VIII, division I.

9.00.00 Reverse Osmosis system

RO system shall include, but not be limited to the following:

9.01.00 Requirements of RO plant

1) Each RO stream shall be provided with a dedicated HP pump. The HP pump designed to operate in the entire range of operation of the feed system.

2) The permeate water is discharged to product water system where it is treated to for removal of excess CO_2, correction of pH, correction of alkalinity (for potabilisation, if applicable) etc. and stored.

3) Permeate shall be delivered to respective Degassifier thru dedicated Suck-back arrangement (if applicable). Cleaning and Flushing systems shall be provided for membrane protection.

4) All wetted parts in the plant shall be constructed with suitable corrosion resistant material suiting to the fluid.

9.02.00 **RO membrane assembly**

Each stream shall be capable of operating either independently or in combination with the other ones. The streams shall be skid-mounted and be furnished complete with all headers and related piping, mounted on the skid. The skid shall be designed to provide ample room for servicing and monitoring the equipment. The isolation or removal of an individual permeator for testing or servicing shall be possible while the RO-train is in operation, by means of flexible, self-closing couplings.

9.03.00 **RO membrane**

The Reverse osmosis membrane shall be spiral wound type. The membrane shall be non-telescopic, non-flexing and leak free. The RO membranes shall be supplied from manufacturers well experienced in RO plant design of stream capacity comparable to that of this project. This shall be demonstrated by the Bidder with adequate references of his selected membrane manufacturer(s). He also shall include a design calculation of the RO plant by his preferred manufacturer(s)

The process design shall take into consideration specified *fouling allowance and salt passage* during the guaranteed (specified) life of the membrane. Standard Length & Diameter of membrane used for design should be available from at least three

manufacturers to deliver water of specified quality so that Employer may install membranes from other manufacturers during operation stage of the plant.

*The membranes supplied shall be from the fresh lot (manufactured not later than 12 months from the date of commissioning) and shall be stored and preserved at site in line with the OEM guidelines. (Applicable for RO and UF both)

9.04.00 **Pressure vessels**

Pressure vessels shall have a diameter and length to contain required numbers standard diameter, standard length spiral wound elements Materials to be selected shall meet the following minimum requirements:

i)	Membranes	As per manufacturer
ii)	Pressure vessels	PP or proven material as per manufacturer
iii)	End caps or plates	Non-metallic material of proven reliability; Fliberglass epoxy as minimum requirement
iv)	Segmental rings, Connectors,	Corrosion resistant material conforming to ASTM A312 SS-316 or equiv.

The design, fabrication, and testing requirements for the pressure vessels shall be in accordance with ASME Section X to allow a code stamp, or meet the minimum requirements of ASME Section X.

9.05.00 **High pressure pump and Energy recovery units**

The HP feed pump (SS-316) shall be of centrifugal type. Selection of parameters (Capacity & Head) of HP Pump, its drive shall consider requirements of membrane manufacturer and shall be designed to deliver required parameters throughout the design life of membrane.

9.06.00 **Clean in place system (CIP)**

The cleaning system shall be designed for cleaning and sterilizing of minimum one train of the RO system separately. The RO-plant shall be provided with fixed pipe connections. Provisions must be made for the neutralization and disposal of chemical cleaning waste via the brine reject.

Flushing system (if applicable)

Flushing system consisting 2 x 100% flushing pumps shall be provided to enable flush-out of the RO unit stream including HP pump, with Low TDS permeate water during shut down of the stream.

09.07.00 **Sample panel**

Each RO unit/train shall be fitted with a fiberglass sample board, which shall be mounted adjacent to the unit. The panel and supports shall have all fiberglass constructions with a minimum 8” wide trough under the sample cocks with 1” PVC drainpipe routed to the trenches. Sample tubing shall be black tubing. The sample panel shall use ¼” SS sample cocks to sample the following

i) Feed (locate on common manifold)

ii) Concentrate (locate on common manifold)

iii) Permeate (locate on common manifold)

iv) Permeate from each pressure vessel

Sample valves shall be SS white snap-action valves and shall be fitted with plastic nozzles tubes.

09.08.00 Degasser system

Degasser tower shall be designed to reduce dissolved Carbon-dioxide (CO_2) in treated water to the level indicated in the guarantees. Fill Material of degasser tower shall be Polypropylene or equivalent. Blowers shall be provided to remove CO_2 from water. Degasser tower & degassed water tank shall be internally rubber lined of minimum thickness of 4.5 mm and externally painted with epoxy.

09.09.00 Piping/Valves

The Technical requirement of Piping, Valves & fittings shall be as defined/specified under subsection titled “Piping, Valves & Fittings” in Part-B of Technical Specification

10.00.00 **Mixed Bed (MB) Polisher Units**

The minimum technical requirements equipment shall include, but not be limited to the following:

Design surface flow rate at design flow shall not be more than 35 m^3/m^2/hr. Resins-strongly acidic and strongly basic Type-I, both the resin shall be of high capacity polystyrene resins in bead form. Total resin bed depth shall be 1.0 m (min). Air-blowers for mixed beds shall be provided. Mixed Bed shall be regenerated after minimum 30 hours of operation followed by regeneration period not exceeding 6 hours.

Atleast100% free board shall be provided over resin bed below the backwash outlet nozzle and in straight portion of vessel to allow for expansion during backwashing and for addition of extra resin, if required.

10.00.00A **UF & RO system (Control & Operation philosophy)**

1) The control & operation of various systems described below is indicative only and the actual control & operation philosophy shall be finalized with during detailed engineering based on which the control logic is to be built by the contractor in DDCMIS.

2) Normally drawl of product water (either raw water or DM water) requirement plant shall be from a single tank while the other tanks shall be in filling mode from the RO streams/trains. Operation of pumps which draw water from the storage tanks shall be interlocked with the tank level and /or pressure at the suction header, high pressure at the discharge header. The field instruments provided by Contractor along with tanks & suction header shall be used for implementation of such logic.

3) It shall be possible by the Operator one or more tanks for drawl mode and other for filling mode. In auto mode, the tank (s) under drawl mode shall switch over to filling mode at a pre-set level in tank and drawl for the plant shall be continued from the tanks which were under filling mode. Upon reaching high level in all the storage tanks, the running streams/trains shall be shut down in sequence. Similarly, the low level in all the tanks shall initiate starting of stream(s) in sequence which are under standby mode/stopped.

4) Post treatment of RO

Water flow to degassers shall be interlocked with the level in degassed water storage tanks as well as pH of permeate. Degasser blower’s operation shall be interlinked with the operation of associated degasser tower. The standby blower associated with the tower in operation shall come into operation in the event of failure of running blower. The operation of pumps shall be interlocked with the level of the degassed water tank. The

performance of respective degasser shall be monitored thru measurement of conductivity & pH of product water.

5) RO system.

RO plant shall be operated and controlled thru control system.

The system shall provide the following:

i) Alarms for high permeate conductivity of each skid, Low pH of feed water, High pH of feed water, high feed water temperature, availability of chemical dosing system such as low level in dosing tanks, status of dosing pumps etc.

ii) Continuous monitoring for Feed temperature, Feed pH, conductivity of feed water & permeate, SDI of Feed water, pressure of Feed water, permeate & concentrate, flow of feed water, Permeate & concentrate, residual chlorine of feed water.

The HP pumps shall be operated thru control system. Start/ Stop of HP pump shall be interlocked with opening & closing of suction & discharge valves. The pump shall start with its discharge valve closed and on stop/trip command the discharge shall be interlocked to close before the pump stops. Low pressure in the pump suction and high pressure in the pump discharge shall raise an alarm and trip the pump.

The operation and control philosophy & instrumentation of Variable Frequency Drive (VFD) and Energy recovery units (ERU) (if applicable) shall be as per the recommendation of the manufacturer.

6) Permeate transfer pumps.

The pump shall be provided with interlocks to trip the pump on Low suction level. The low-pressure signal from pressure transmitter in the discharge header shall start the standby pump when the system is in auto mode.

The HP pumps and motor bearings shall be provided with vibration monitoring for measuring vibration levels and vibration “High” and “High-High” alarm shall be annunciated.

Additionally HP pump shall be tripped/shutdown under High conductivity in the RO permeate line, high pH in the Feed water line, high feed water temperature, low level in chemical dosing tank, high feed pressure, high differential pressure across permeators, high residual chlorine of feed water, high SDI in feed water and failure of flow control valve,

7) Clean-in-place system

The operation of agitators/mixers of chemical tank can also be initiated manually by means of local start/stop through DDCMIS, apart from automatic operation. (Option for local/remote control shall be selected through OWS of the control system.) During normal operation mixing shall be automatically started on the initiation of cleaning operation. The cleaning system pumps shall be started during the cleaning cycle progress. The pumps shall be provided with interlocks to trip on low level of chemical tanks. The cartridge filter shall be provided with a differential pressure measurement to monitor the pressure drop across the filter. Selection of RO block/train to be cleaned shall be manual through control system.

8) Flushing system

These pumps shall be selected started and stopped either locally, envisaged under DDCMIS or remotely thru control system (Option for local / remote control shall be selected through OWS of the control system.) During normal operation pump operation shall be automatically started on the initiation of flushing operation. Auto / manual selection switch is provided to select the mode of operation. The pump shall be provided with interlocks to trip the pump on Low suction level. The low-pressure signal from Pressure transmitter in the discharge header shall start the standby pump, when the system is in auto mode. Selection of RO block / train to be flushed cleaned shall be shall be manual through control system.

9) Suck-back (If applicable) The operation of suck-back shall be automatic.

10.01.00 **UF system**

1) The control & operation of various systems described below is indicative only and the actual control & operation philosophy shall be finalized with during detailed engineering based on which the control logic is to be built by the contractor in DDCMIS.
2) The system shall provide the following:

   i) Alarms for, High permeate SDI, availability of chemical dosing system such as low level in dosing tanks, status of dosing pumps etc.

   ii)Continuous monitoring for pressure of Feed water, flow of feed water & Permeate.
3) Start/ Stop of feed pump shall be interlocked with opening & closing of suction & discharge valves The pump shall start with its discharge valve closed and on stop/trip command the discharge shall be interlocked to close before the pump stops. Low pressure in the pump suction and high pressure in the pump discharge shall raise an alarm and trip the pump.
4) The operation and control philosophy & instrumentation of variable frequency drive for UF units (VFD) (If applicable) shall be as per the recommendation of the manufacturer.
5) Also feed pump shall be tripped/shutdown under high feed pressure, high Differential pressure across permeators.

Flushing system

Filter backwash operation shall be initiated whenever head loss across the filter reaches preset point or after specified filtration cycle or at the specified effluent quality of high SDI. The logic to be selected shall be decided by Operator through control system. Upon initiation, filter backwash shall proceed automatically.

11.00.00 **Chlorine di-oxide (ClO_2) plant**

The minimum technical requirements equipment shall include, but not be limited to the following:

The Contractor shall offer only proven design in successful operation in similar application at previous installations. Design capacity of generator(s) for CW system & PT system shall meet requirement for ClO_2 dozing for the total circulating water flow to maintain a free chlorine dioxide residual of at least 0.2 mg/l in the far reaches of the distribution system at all times. However, the minimum capacity of chlorine di-oxide plant(s) shall be as follows:

CW System - Shock dosing is proposed to be provided, which shall be done minimum 3 times a day (once per shift).

PT System - Continuous dosing is proposed to be provided.

No stand-by generator is proposed in ClO_2 system for CW. However, stand-by equipment w.r.t pumps, tanks, piping & valves etc. shall be considered by Contractor. Chlorine-di-oxide dosing shall be provided at aerators, stilling chambers of PT systems. For controlling organics in circulating water system, ClO_2 dosing may be provided in CW Forebay channel.

11.01.00 **Design requirement**

1) The chlorine di-oxide generators (Submerged / encapsulated type) shall ensure that the formation of the ClO_2 solution takes place completely underwater and the reaction chamber shall be surrounded by water to avoid any ClO_2 gas leak.
2) The ClO_2 shall be generated in diluted solution of concentration of ≤ 1500 mg/l. The generator/reactor shall have a yield of 90% or higher. For consumption of reagents, 90% yield should be considered. Provision for measuring the yield shall be provided.

3) The system shall also have necessary sampling valve for periodic measurement of concentration of ClO_2 at the generator outlet to prove and monitor the conversion efficiency of ClO_2 generator.

4) The design of chlorine dioxide system should include safety, handling of precursor chemicals viz $NaClO_2$ and HCl, water source, chlorine dioxide distribution and physical location of all generation equipment & associated accessories.

5) The contractor must include all the necessary additional features, functions & equipment for safe & consistent operation of chlorine di-oxide system, as per national & international guidelines and safety requirements. Certifications/Statutory clearances from directorate of explosives or any other authorities; if any required, shall be obtained by the contractor.

6) The ClO_2 generation system shall have variable dosing rate of 10% to 100% of the design dosing rate or better.

7) To have optimum accuracy, the dosing pumps used shall be with powerful variable speed stepper motor with internal stroke speed control and have a minimum turn down ratio of 1:800 for precise control of ClO_2 generation. Accuracy should be +/-1 % or better. Dosing pump should have LCD display to see the capacity set and alarms if any.

8) Dilution water pumps shall be equipped with suitable VFD to control the speed for varying the flow rate. Contractor shall provide neutralizing chemical for HCl and $NaClO_2$ and shall design the neutralization system with all required accessories. Separate Neutralization pits for HCl and $NaClO_2$ shall be provided.

9) Chemical preparation tanks with necessary agitation requirement shall be provided as required. After neutralization, the neutralized wastewater shall be pumped to N-pit.

10) The bulk storage Tanks shall be provided with dyke wall of suitable height (minimum 500mm) or to hold chemical of 1 tank capacity with freeboard of 50 mm, whichever is higher. The dyke area shall be provided with Acid proof lining. The Unloading Pumps area shall be provided with a kerb wall and the kerbed area shall also be provided with Acid proof lining. Suitable dyke wall/barrier shall also be given in between HCl & $NaClO_2$ tanks to avoid any kind of mixing. Arrangements shall be made to transfer the chemical from one tank to another for greater flexibility & in case of leakage; provision shall be made to recycle the chemicals back to tanks from the dyke area for both chemicals ($NaClO_2$ & HCl).

11) Bidder shall take full responsibility that all the materials and components of valves, pumps, piping and any other equipment and appurtenances shall be proven and compatible with the respective fluid therein.

12) ClO2 leak sensor with detector shall be installed inside the room. The least count of sensor shall be 0.1 ppm or better and the complete ClO_2 generation system including the dosing pumps shall stop automatically. The ClO_2 leak sensor shall be of reputed make with proven track record. Industrial type-high decibel hooters shall be provided for each of the ClO_2 plants (PT & CW).

13) Air contact with chlorine dioxide solution should be controlled to limit the potential for explosive concentrations possibly building up within the reactor.

14) The skid MOC shall be of carbon steel with suitable painting/coating having sufficient strength and rigidity to support the equipment contained in the skid.

15) The following instruments shall be provided as a minimum.

   a) pH in Chlorine di-oxide solution dosing line.

   b) Residual chlorine di-oxide (ClO_2) analyzer.

   c) Flow meters on all chemical feed lines, dilution water lines, and chlorine dioxide solution lines.

d) Pressure indicator & controller on the water inlet line to ClO_2 generators, chlorine dioxide dosing controller, low vacuum switch, solenoid valves, etc., all complete and as required shall be provided.

e) The dosing in inlet shall be automatically controlled based on the signal received from residual chlorine dioxide analyzer in the header.

f) All chemical storage tanks shall have automatic high and low level cut off.

g) Chlorine di-oxide leak detection system.

h) In case of water supply to the generator stops, the chemical dosing pumps shall also stop automatically.

i) Generator must be equipped with systems of dosing and/ or measurement for reagents and diluting water. These systems must be able to shut down the operation of the generator in case any of the supplies is cut off.

11.02.00 **Material of Construction**

Components	Material of construction
ClO_2 generator	PVDF sandwiched with FRP protection for better reliability/Equiv. PVDF
Piping & Valves	Industrial Grade CPVC
Chemical Storage Tanks	FRP

11.03.00 Applicable Codes and Standards

The design, material, construction, manufacture, inspection, testing and performance of the chlorine-dioxide plant shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest editions of all standards and codes (along with all addenda), mentioned below and elsewhere in the specification. Nothing in this specification shall be construed to relieve the contractor of this responsibility.

i) ASME Standards for various tests and materials.

ii) ASME – Boiler and Pressure Vessels Code Section VIII, Div.1 and sect. IX.

iii) ANSI B 16.5 Standard for Steel pipe flanges and flanged fittings.

iv) IS – 5120 – Technical requirement for Rotodynamic pumps.

v) Chlorine Institute Manual of USA

vi) ASTM D 1784 and F 441 & F 439 - CPVC Pipe and Fittings.

vii) ASTM and BIS Specifications for CPVC, PP, FRP

11.04.00 **Piping**

Industrial grade CPVC Schedule-80 piping shall be used which can withstand a temperature of minimum 60°C. The arrangement of piping and valves should be for ease of service and operation. Cleaning connections are to be provided for flushing. Piping should be lighter in weight with no corrosion and high fire performance. The piping should be easy to fabricate and assemble and in case of any damages, it should be easily replaceable.

11.05.00 **Valves**

All valves in Chemical dosing lines (Acid, Sodium chlorite, chlorine dioxide etc.) shall be of industrial grade CPVC PN16 rating (minimum). Type of valves and material of construction for various other applications in the ClO_2 plant shall be selected by the Contractor as per its proven practice. However, all the valves in contact with chlorine dioxide solution should be leak tight and preferably of diaphragm valves with Teflon diaphragm

DATA SHEETS

12.00.00 **Pre-treatment plant**

NO	DESCRIPTION	PT-CW System	PT-DM System	Coal Slurry settling System (CSSP)
I	**Aerator, Stilling chamber and Inlet channel**			
II –A)	**Aerator/Stilling Chamber**	**PT-CW System**	**PT-DM System (Options-I & II)**	**Coal settling System (CSSP) (Stilling Chamber)**
1)	Design Flow (min.)	3840 m^3/hr.+ 3% for sludge	300 m^3/hr.+ 3% for sludge	2000 m^3/hr + 3% for sludge
II-	**CLARIFIERS**			
1)	Type	---------- Circular Reactor type ----------		
2)	Design Flow of each clarifier (Net output) (minimum)	1650m^3/hr	300 m^3/hr	2000 m^3/hr
3)	**Reaction Turbine**	With variable frequency drive as per Manufacturer's Standard		
4)	**Clarifiers Scrappers**			
	a) Number	--------One (1) assembly per Clarifier--------		
	b) Material of construction	---------- Mild steel with rubber inserts ------ (with bitumastic paint protective coating)		
	c) Drive	Slow speed Motor driven through reduction gear unit or variable frequency drive as per manufacturer's standard		

13..00.00 **Gravity filters**

NO	DESCRIPTION	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+MB)	PT-Potable water System
I)	**Gravity filters**			
1)	Design flow per gravity filter	130 m^3/h+2%	200 m^3/h+2%	100m^3/h+ 2%
2)	**Air Scour Blowers**			
	ii) Type		Rotary Twin lobe / centrifugal	

NO	DESCRIPTION	PT-DM System (Ion Exchange)	PT-DM System (UF+RO+MB)	PT-Potable water System
	iii) Capacity & head		As per design	
	Material of Construction			
	1) Casing, cover & stator		Cast Iron IS:210 Gr. FG 260	
	2) Impeller/Lobe		Cast Iron IS :210 Gr. FG 260	
	3) Shaft		Carbon steel BS:970 En-8/ANSI-I045	

V)	Filtered Water Reservoir/ Sump/ Pump House	PT – DM	PT – Potable
1)	Effective capacity of each reservoir/sump (minimum)	150 m^3	75 m^3
2)	Electric Monorail hoist in Filtered Water Pump house		
	a) Number	----------One (1) (Common)----------	
	b) Minimum Capacity	---------- 2T ----------	

14.00.0 **Clarified Water Storage Tank /Sludge / Backwash Water Pit/Sump**

I	Clarified Water Storage Tank/Distribution Chamber (Above Ground)	
1)`	Effective Capacity (retention time)	Minimum 15 mins.
III	Sludge pit/sump & pump house (common)	
1)	Number of Sludge pit	One (1) in two (2) sections
2)	Effective capacity of each section	Not less than 200 Cu.m
IV	Backwash water Pit/Sump & pump house (common for PT-DM & PT-Potable)	
1)	Number of pits	One (1) in two (2) sections
2)	Effective capacity each section	Not less than 200 Cu.m
3)	Material of Construction	RCC with Acid alkali proof lining

15.00.00 Pumps (Vertical/Horizontal/Metering)

A. Vertical Sump Pumps		
NO	Application	Sludge, Wastewater, Back washing
1)	Service of duty	----- Continuous, Outdoor -----
2)	Type of pump	------Non-clog ----
3)	Type of Discharge	---- Above Floor discharge ---------
4)	Type of impeller	---------- Open ----------
	Suction condition	---------- Submerged ----------
5)	Minimum Water level	----------By Bidder ----------
6)	Maximum Water level	--- Local Finished Grade level-----

A. Vertical Sump Pumps		
NO	**Application**	**Sludge, Wastewater, Back washing**
7)	Operating floor level	----Minimum 500 mm above FGL-
8)	Type of shaft coupling	-------Flexible / Rigid ------
9)	**Material of Construction**	
	Suction Bell /Casing	2.5 % Nickel Cast Iron, IS: 210 Grade FG 260; S-0.1% max. P-0.15% max.
	Impeller	ASTM A351 CF8M
	Shaft	---------- SS-410 ----------
	Column pipe & Discharge pipe	IS:2062 (minimum thickness 8 mm) with 2 coats of epoxy coating inside & outside.
	Shaft enclosing tube (if applicable)	----------do ----------
	Bolts & nuts	SS
	Base plate and Soleplate	CS (Minimum 10 mm thick)

B. Vertical Turbine (Wet pit) Type Pumps		
NO	**Application**	**Coal Decanted Water**
1)	Service of duty	----------Continuous, Outdoor ---------- -------
2)	Type of pump	Non-pull out type.
3)	Type of Discharge	-------Above Floor discharge ---------
4)	Type of impeller	----------Closed / Semi-open ---------
	Suction condition	----------Submerged ----------
5)	Minimum Water level	---------- By Bidder ----------
6)	Maximum Water level	-Local Finished Grade Level (FGL)
7)	Sump Invert level	------- As per design-------
8)	Operating floor level	---Minimum 500 mm above FGL ---
9)	Type of shaft coupling	----------Flexible / Rigid ----------
10)	**Material of Construction**	
i)	Suction Bell	2.5%NiCI; IS: 210 Gr. FG 260; S-0.1%& P-0.15% max.
ii)	Casing/Bowl	2.5%NiCI; IS: 210 Gr. FG 260; S-0.1%& P-0.15% max.
iii)	Impeller	ASTM A 351 CF8M
iv)	Wearing rings (if applicable)	---As per manufacturer's Std --
v)	Impeller Shaft, Pump & line shaft	------SS ASTM A 276 Gr. 410. ------
vi)	Shaft bearings	As per manufacturer's standard
vii)	Column pipe	IS:2062 (minimum thickness 8 mm) with 2 coats of epoxy coating inside & outside.
viii)	Bolts & nuts	SS
ix)	Base plate and Soleplate	IS: 2062 (Minimum 10 mm thick)
x)	Accessories to be provided with each pump	Companion flanges with nuts, bolts and gaskets, Positioning dowels, Eye bolts, lifting etc. Non –reverse ratchet shall be provided as per manufacturer's standard practice.

C	Horizontal Centrifugal pumps	
NO	Application	Filter water, DM water, Permeate water, Alkali, Degassed water, Flushing, Chemical cleaning, Brine Solution
1)	Service of duty	---------Continuous, outdoor ---------
2)	Type of pump casing	---------- Radially Split type --------
3)	**Material of Construction**	
i)	Casing	ASTM A351 CF8M
ii)	Impeller	ASTM A351 CF8M
	Wearing rings	SS – 316
iii)	Shaft	SS-410
iv)	Bolts & nuts	SS
v)	Base plate	CS (Minimum 10 mm thick)

D.	Metering pumps – Alum dosing pumps				
No	Designation	:	PT-CW System	PT- DM System	Tube settlers/ Lamella Clarifiers
1)	Type	:	---------Simplex hydraulically operated Diaphragm type -----		
2)	Capacity (minimum)	:	As per design	As per design	As per design
3)	Head	:	As required	As required	As required
4)	Liquid to handled and concentration	:	---------- Alum solution 10% W/V ---------		
5)	Capacity control	:	10 --100% of capacity manually by micrometer dial		
6)	Pump stroke speed per minute	:	---------- Maximum 100 ----------		
7)	**Material of Construction:**				
	Liquid end (pump head valve, valve housing etc), valve spring		----------AISI -316 ----------		
	Diaphragm		---------- PTFE ----------		
	Packing		---------- PTFE ----------		
	Shaft		Hardened steel EN8-BS-970)/ AISI-316--		
8)	Accessories		Pressure dampeners, Safety Relief valves etc. required		

E)	Coal Handling Plant Run-Off Water Treatment System	
1)	Number of Coal Slurry Settling Ponds (CSSP)	Two (2)
2)	Material of Construction	RCC
3)	Capacity of each pond of CSSP	1000 cum (Min.)
6)	**Coal decanted sumps**	
	i) Number of Sump	One(1) in two (2) sections

	ii) Effective capacity of each section	Not less than **250** Cu.m
	iii) Material of construction	----------RCC ----------
	iv) Coal decanted water pump	As specified

16.00.00 **Chemical house equipment**

A.	**Chemical house equipment**			
I)	**Weighing Scales**			
1)	Type		Platform & Dial type/Electronic type	
2)	Number & Capacity		One of 0-500 Kg & One of 0-2000 Kg	
II)	**Monorail hoist**			
1)	Type		Electrically operated	
2)	Number and Capacity		Two (2) numbers each of 1 Ton capacity	
III)	**Chemical Tanks**	**Lime Slaking Tanks**	**Lime Solution Preparation Tanks**	**Alum Solution Preparation Tanks**
1)	Number	Bidder to decide		
2)	Material of construction	RCC (with 2 coats of Bitumastic paint over 2 coats of primer)		RCC (with Acid/Alkali resistant tiles)
3)	Effective Capacity of each tank (minimum)	As per bidder's design		
4)	Agitator & Number	Motorized with reduction gear unit ;1 per tank		
5)	Dissolving Chamber	---------SS--------		
6)	Agitator shaft & Impeller matl.	---------- SS -316 ----------		
B	**Chlorination (ClO_2) Plant**			
I)	**ClO_2 Plant/ System**		**CW System**	**PT System**
1)	Capacity (minimum)		2 x 75 kg/h (2W)	2 x 10 kg/h (1W+1S)
C)	**Waste Service Water Treatment System**			
I)	**Sumps/ Tanks**		**Waste Service Water Sump (WSWS)**	
1)	Effective capacity of each section		Not less than 250 Cu.m	
2)	Material of construction		----------RCC----------	
3)	Oil skimmer, centrifuge		As per system requirement	
II)	**Tube settlers/ Lamella clarifiers**			
	i) Design Flow (net output)		Not less than 250 Cu.m/hr	
D)	**Treated/Service Water System**			
I)	**Treated Water Tank/ CMB (Above Ground)**			
1	Number of Treated/Service Water Tank		One (1) in two(2) sections	
2)	Effective Capacity each section (minimum)		250 Cu.m	
3	Material of construction		----------RCC ----------	

XIV)	**Service Water Tank & Pump House**	
1)	Number of Basin	One (1) number in twin sections
2)	Material of Construction	RCC
3)	Effective Capacity each section (minimum)	250 Cu.m

17.00.00 **Ion exchanger unit (Cation exchangers, Anion exchangers and MB units)**

A	**DM plant streams**					
1)	Stream Capacity (Each)			120 Cum/hr		
B	**Activated Carbon Filter**					
1)	Type			Vertical shell type with dished ends		
2)	Number of units per stream			One (1)		
3)	Design Flow per unit (Net)			120 Cum /hr.		
4)	Period between two successive back wash (Design)			24 hours		
5)	Design surface flow at design flow (maximum)			15 m^3/hr./m^2		
6)	Design Pressure of Vessel (minimum)			8 Kg/Sq.cm (g)		
7)	Filter Media / Resin			Activated Carbon		
8)	Minimum bed depth of filter media/ Resin			1200 mm		
9)	Supporting material for the fill			Graded gravel		
10)	Shell & dished end material			Mild Steel as per specified code		
11)	Internal painting			Epoxy Paint		
12)	External painting			Chlorinated Rubber Paint		
13)	Number of Manhole per Vessel			Minimum Two (2)		
14)	Number of Sight windows with minimum clear width of 75 mm			Minimum Two (2)		
C	**Ion exchanger units**	**Cation Unit**		**Anion Unit**		**Mixed Bed unit**
		Weak	**Strong**	**Weak**	**Strong**	
1)	Type	Vertical shell type with torispherical dished ends				
2)	Number of Streams	Two (2)	Two (2)	Two (2)	Two (2)	Two (2)
3)	Number of units per DM stream	----------One (1) ----------				
4)	Design Flow per unit (Net) in **m^3/h**	120		120		120
5)	Guaranteed Effluent Quality	Refer Subsection-IV of Part-A of Technical Specification				
6)	Period between two (Design) successive regenerations in **hours**	12		12		108
7)	Net output between two successive regenerations in m^3	1440		1440		12960
8)	Design surface flow at design flow (maximum)	As specified elsewhere				
9)	Resin	Weakly Acidic Carboxylic Group	Strongly acidic, high capacity polystyrene	Tertiary Ammonia Group	Strong base, Type-I, high capacity polystyrene resin in bead form	Strongly acidic and Strongly basic Type-I resins. Both resins of

A	**DM plant streams**					
1)	Stream Capacity (Each)			120 Cum/hr		
			resin in bead form			high capacity polystyrene resins in bead form.
10)	Resin Depth					
a)	Minimum bed depth of Resin for Counter current regenerated vessels over bed plate/header lateral.	------ 1000 mm -------				--------
b)	Minimum bed depth of filter Resin for Co-current regenerated vessels over bed plate/header lateral .	----- 800 mm -----				--------
c)	Minimum (Total) bed depth of Resin over bed plate/header lateral	----------				1000 mm
11)	Shell & dished end material	---------Mild Steel as per specified code ---------				
12)	Design Pressure of Vessels	---------- 8 Kg/cm² (g) (minimum) ----------				
13)	Shell (Internal) lining Material & Thickness	------ Rubber & minimum 4.5 mm (thick) -----				
14)	External painting	---------Chlorinated Rubber Paint ----------				
15)	Number of Manhole per Vessel	----------Minimum Two (2) ----------				
16)	No of Sight windows with minimum clear width of 75mm	---------- Minimum Two (2) ----------				
17)	Regeneration	By HCl		By NaOH		By HCl & NaOH

Degasser system

A	**Degasser towers**	
1)	Number of units per DM stream	One (1)
2)	Type	Forced draft type
3)	Design Flow per unit (Net) in Cu.m/hr	120
4)	Fill Material	Polypropylene or equivalent
5)	Shell material	Mild Steel as per specified code
6)	Shell (Internal) lining Material & Thickness	Rubber & minimum 4.5 mm
7)	External painting	Epoxy Paint
B	**DEGASSED WATER STORAGE TANK**	
1)	Type	Horizontal cylindrical atmospheric with dished ends

A	Degasser towers	
1)	Number of units per DM stream	One (1)
2)	Design Standard (for diameter, length & thickness)	As per BS: 2594. However, dished ends shall be of Torispherical type
3)	Number of units per DM stream	One (1)
4)	Useful (Effective) Capacity (minimum)	As per Bidder's design
5)	Shell material	Mild Steel as per specified code
6)	Shell (Internal) lining Material & Thickness	Rubber & minimum 4.5 mm
7)	External painting	Epoxy Paint

18.00.00 Brine preparation & pumping system

A	Brine Solution Preparation Tank	
1)	Material of construction	Mild steel (Internally rubber lined and externally painted with epoxy paint)
2)	Number & Effective Capacity	As per Bidder's design
3)	Dissolving basket, Agitator	SS -316.

19.00.00 **A. Regeneration (Chemical handling/Unloading & Storage) system**

A) Chemical Unloading Pumps		Acid	Alkali
1)	Duty	Intermittent Intermittent	
2)	Material of Construction		
	i) Casing, impeller, wearing rings	PP	SS-316
	ii) Shaft, shaft sleeve	PP/ EN-8, Mfg. std.	SS-316
	iii) Sets of Hoses with coupling & Diaphragm type Isolation Valves	Material of Hose: Chemical resistant, UV inhibited PVC	
3)	Number/Length of Sets Required	Two (2)	

B. Regeneration storage, Chemical preparation & Dosing system

A) Bulk Storage Tanks		Acid	Alkali
1)	Type	Horizontal Cylindrical atmospheric with dished ends	
2)	Design Standard	As per BS: 2594, Dished ends shall be of Torispherical type	
4)	Liquid to be handled	HCl 30-33% Conc.	NaOH 48% Conc.
6)	Shell material	Mild Steel	
7)	Shell (Internal) lining Material & Thickness	Rubber Lining (4.5 mm Thick)	

VII-B) Tanks / Vessels		Acid Measuring Tank	Alkali Preparation Tank	Alkali Day Tank
1	Type	Vertical Cylindrical atmospheric		
2	Numbers required	Two (2)	Two(2)	Two (2)
3	Liquid to be handled	HCl	NaOH	NaOH

4	Minimum (Effective) Capacity	As per bidder design or 2 cum (whichever is minimum)	As per bidder design or 5 cum (whichever is minimum)	As per bidder design or 2 cum (whichever is minimum)
5	Location	---------- To be designed for outdoor duty (Located under a roof without side walls) ----------		
6	Shell material	--------- Mild Steel as per specified code --------		
7	Shell (Internal) lining Material & Thickness	---------Rubber & minimum 4.5 mm ---------		
8	External painting	---------Chlorinated Rubber Paint ---------		
9	Material of Dissolving basket	Not applicable	SS -316	SS -316

VII-C) Tanks / Vessels –Contd		**AC Filter for Alkali**	**Alkali Diluent Water Heating Tank**
1	Type	Vertical Cylindrical Pressure vessel with dished ends	
2	Capacity	As per bidder design or 10 Cu.m/hr whichever is minimum	
3	Design surface flow	15 M^3 / hr / M^2	Not applicable (NA)
4	Design Pressure of Vessel	---------- 8 Kg/ Sqcm (minimum) ----------	

19.01.00 **Neutralizing system (DM Plant) (Option-I,II)**

A) N-Pit

1)	Number	One (1) in two sections
2)	Material of Construction	R.C.C with acid/alkali proof tiles
3)	Corrosion Protection for gates	Acid/Alkali proof chlorinated paint & rubber lined.
4)	Effective capacity of each section	250 cum

B) N-Pit waste Re-circulation cum-disposal pumps

1)	Type of Pumps	Horizontal centrifugal with priming system
2)	Total Number of Pumps	Three (1W+1S +1 Maint.Spare)
3)	Duty	2-4 hrs every shift
4)	Liquid to be Handled	DM Plant Regeneration waste
5)	Pumps and drives to be designed	For Outdoor duty
6)	Suction condition	Suction from priming chamber/submerged (suction from pit)
7)	Guaranteed Flow of each pump	Capacity to evacuate total pit in 3 hours
8)	Total head	As reqd.
9)	Maximum pump Speed	1500 rpm (nominal)
10)	Type of pump casing	Preferably Radially Split type
11)	Type of impeller	Closed / Semi Open

C) Lime tanks for neutralisation

1)	Numbers. required	One (1)
2)	Type of construction	RCC
3)	Effective Capacity (Minimum)	2 CuM
4)	Inside protection	Epoxy
5)	Dissolving basket, Agitator	SS -316.

D) Backwash wastewater collection & recycling system

D1	Back Wash Waste water Collection Pit & Sump (DM)	
1)	Number	One (Twin sections) with a common sump
2)	Material of construction	R.C.C. with Acid / Alkali proof lining
3)	Effective capacity each section	Not less than 180 Cu.M
4)	Corrosion Protection for gates	Acid/Alkali proof chlorinated paint & rubber lined.

D2	Back Wash Wastewater Recirculation cum disposal pump (Vertical Sump Pumps)	
1)	Location	In Filter Backwash Sump
2)	Capacity of each pump	Capacity to evacuate the pit in 2 hrs.
3)	Total head	As per bidder's design
4)	Type of pump	------Vertical, non-clog, Sump pumps -----
5)	Type of Working Fluid	---Drains with particle size up to 40 mm
6)	Type of impeller	---------- Open ----------

20.00.00 **DM water storage tanks (Option-I,II)**

1)	Type	Vertical Cylindrical atmospheric
2)	Design Standard	IS :803
3)	Numbers required	Two (2)
4)	Shell material	Mild Steel as per specified code
5)	Shell thickness (min.)	Bottom most Course -10 mm Balance Courses – 8 mm
6)	Bottom Plate Thickness (min.)	10 mm
7)	Roof Plate Thickness (min.)	6 mm
8)	Internal Protection	Solvent free epoxy coating
9)	External painting	Epoxy Paint
10)	Manholes	Minimum 2 numbers (one on the shell and other on the roof)
11)	Accessories	a) Staircase & platform b) Vent, Overflow and drain connections c) Overflow seal d) CO_2 absorbers in vent line e) e) Hand railing on the roof of the tank all around the tank
12)	Additional nozzle connections	a) Minimum Two (2) Numbers one of 250 NB size & another of 150 NB size at bottom level (for suction). b) Minimum Two (2) numbers one of 150 NB size & another of 100 NB size at the top level (for future filling)

21.00.00 **UF-RO & MB Plant**

A	Ultrafiltration unit (UF)	
No	Descriptions	Parameter /Data

1)	Nos. of trains	2x60 %
2)	Feed Temperature	10-35 Deg C
3)	Recovery from UF	Not less than 92%
4)	UF Treated (Filtrate) Flow	Capacity of each UF to match with gross capacity of RO + water required for backwashing of UF+ Chemical preparation. Additional 5% margin over the total requirements
B	**Basket strainers**	
1)	MOC	SS-316
C	**UF permeate water storage tank**	
1)	Fluid to be Stored	Permeate Water produced from UF
2)	Type of Tanks	Vertical Cylindrical Atmospheric
3)	No of tanks	Two(2)
4)	Design Standard	IS : 803
5)	Effective capacity of Tank	Minimum 1 Hr. retention
6)	Material of construction	MS as per specified code
7)	Shell thickness	Bottom most layer : 10 mm (min.) Balance layer : 8 mm (min.)
8)	Bottom plate thickness	10 mm (minimum)
9)	Inside protection	Solvent free epoxy coating
10)	External painting	Epoxy coating.
11)	Accessories, Additional nozzle connections	Ref DM tank above

D. UF permeate transfer pumps		
No	**Description**	**Parameters/ Data**
1)	Purpose	To pump UF permeate to RO units via cartridge filters
2)	Type of pumps	Horizontal Centrifugal (With VFD)
3)	Design flow (Cum/hr)	To suit the gross capacity of RO system requirements
4)	Rated Head of pump in MWC	As per bidder's design

E. UF BACKWASH WATER PUMPS		
No	**Description**	**Parameters/ Data**
1)	Purpose	For backwashing and CEB of UF skids
2)	Design flow & head	As per bidder's design

22.00.00 **Cartridge filters & RO trains/streams**

A.	**Cartridge filters**	
1)	Filtration Capacity of each filter	Capacity one CF same as capacity of one (1) UF
2)	Numbers	One (1) for each RO stream with a common standby.
3)	Filter Casing & Internals	SS -316
B.	**RO trains /streams**	
1)	Number of trains	3x50% (2W+1S)
2)	Turn Down Capability	One or both the trains shall be operable as per requirement
3)	Design net capacity of each train (Permeate Flow)	Not less than 60 Cu.m/h

4)	Gross capacity of each train	Not less than 60 Cu.m/h +Internal consumption of RO system
5)	Number of Membrane (Block) per Train	One or more as per design
6)	No of Membranes per module	6 - 8
7)	Guaranteed Design Recovery	Not less than 85%
8)	Membrane type	Polyamide, Spiral wound
9)	Average Flux	<20 L/M²h
10)	Fouling Allowance for design	Minimum 5% per year
11)	Salt passage increase	Minimum 10% per year
12)	End connectors	Victaulic coupling or equiv.(SS-316)
C.	**High pressure feed pump**	
1)	Purpose	To pump filtered water at the downstream of Cartridge filters up to the Degasser towers through RO trains.
2)	Number of pumps	One(1) per RO train
3)	Type of Pumps	Centrifugal with VFD
4)	Design flow rate of each Pump	To suit the Gross capacity of each RO train
5)	Rated Head	1.10 x (RO train Feed Pressure + frictional loss in the system)
6)	Service Duty	Continuous
7)	Type of pump casing	As per manufacturer's standard
D.	**RO Permeate water storage tanks**	
1)	Number required	Two (2)
2)	Effective Capacity of each tank	Minimum 1.5 Hr. retention
3)	Type and Pr. class	Vertical cylindrical atmospheric.
4)	Design Standard	As per IS: 803
5)	Material of construction	MS as per specified code
6)	Shell thickness Bottom plate thickness	Bottom most layer : 10 mm (min.), Balance layer : 8 mm (min.) : 10 mm (min.)
7)	Inside protection	Solvent free epoxy coating.
8)	External painting	Epoxy coating.
9)	Accessories, Additional nozzle connections	Ref DM tank above
E.	**CHEMICAL CLEANING SYSTEM**	
1.	**CHEMICAL TANKS**	
1)	Numbers Required	One (1)
2)	Effective Capacity	As per bidder's design
2.	**CHEMICAL CLEANING PUMPS**	
1)	Numbers Required	Two (2) (2x100%) (1W+1S)
2)	Type	Horizontal Centrifugal
3)	Design flow rate of each Pump	Suitable for cleaning of one (1) RO train/stream at a time.
F.	**FLUSHING SYSTEM**	
1)	Numbers of Flushing pumps Required	Two (2) (2x100%)
2)	Type	Horizontal Centrifugal
3)	Design flow rate of each Pump	Suitable for cleaning of one RO train/stream at a time
G.	**DEGASSER SYSTEM**	

1)	Degassed Tower, Degasser blower & pumps	Ref. for DM plant

23.00.00 **MIXED BED (MB) POLISHER UNITS (RO PLANT)**

1)	Type	Vertical shell type with dished ends
2)	Design flow per unit (net)	Not less than 60 m^3/hr
3)	Gross flow rate per MB unit	To be decided by bidder considering DM water required for regeneration.
4)	Service Cycle (period between two (2) successive regenerations)	24 hrs.
5)	Design surface flow rate at design flow	Not more than 35 M^3/M^2/hr
6)	Shell & dished end material	Mild steel as per specified code
7)	Shell lining	
	a)Material	Rubber
	b)Thickness	4.5 mm (minimum)
8)	External painting	Chlorinated rubber paint
9)	Manhole	Two (2) per vessel (Min.)
10)	Sight windows	Two (2) minimum per vessel (Minimum clear width shall be 75 mm)
11)	**Resins**	
	a)Type	Strongly acidic and strongly basic Type-I, both the resin shall be of high capacity polystyrene resins in bead form.
	b)Regeneration	By HCI and NaOH
	c)Total resin bed depth	1.0 M (min)
12)	**Air-blowers for Mixed Beds**	
	Number	Two (2x100%)
	Type	Centrifugal/Twin lobe type
	Capacity & Head	As required

24.00.00 Data sheet for UF/RO other system

A.	**SMBS & Antiscalant dosing system**		
1)		**SMBS dosing tank**	**Anti scalant dosing tank**
	No of tanks	2 W	2W
	Capacity	500 Lit (Min)	500 Lit (Min)
	MOC	MSRL / FRP	MSRL / FRP
	Tank Mixer/Agitator	Turbine Agitator	Turbine Agitator
	MOC of Mixer/Agitator	SS-316	SS-316
2)		**SMBS dosing pumps**	**Antiscalant dosing pumps**
	No.	2(1W+1S)	2(1W+1S)
	Type	Positive displacement	Positive displacement
	MOC	PP	PP

B. UF Permeate transfer pumps and UF backwash water pumps

description		**UF permeate transfer pumps**	**UF filtrate cum backwash water pumps**
1)	Purpose	To pump UF permeate to RO units via cartridge filters	To pump UF permeate to UF storage tank and backwashing of UF

2)	Type of pumps	Horizontal Centrifugal	Horizontal Centrifugal with VFD
3)	Design flow rate of each pump	To suit the gross capacity of RO requirements	As per bidder's design

25.00.00 Design features of "Pressure and Storage Vessels"

1) Design of all pressure vessels shall conform to ASME Section VIII or acceptable equivalent standard. Design pressure shall be the maximum expected pressure to which the vessels may be subjected to plus 5% additional margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pumps suction if any. For all other pressure vessels, design pressure shall be at least 8 Kg/cm² (g).
2) Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali, and other chemicals shall conform to IS: 803.
3) Design of all horizontal cylindrical atmospheric storage tank containing water, acid, alkali, and other chemicals shall conform to BS: 2594.
4) Design temperature of all pressure vessels and storage tanks shall be 10 deg. C higher than the maximum temperature that any part of the vessel/tank is likely to attain during operation. In case, tank is subjected to vacuum, the same shall be taken care in designing the tank.
5) The design of DM water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be "Non-pressure" fixed roof type with atmospheric vents.
6) All vessels/tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end.
7) All the atmospheric tanks shall have sufficient free board above the "Level High"/ "Normal Level" as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the "Level High"/"Normal Level" for all the tanks except for the DM tanks for which a minimum height of 300 mm shall be provided over the "High Level". Further, a minimum 100 mm free board shall be provided above the top of overflow level to the bottom of roof of the tank. Wall thickness of atmospheric tanks shall not be less than 6 mm.
8) Vessels coming under preview of IBR shall be designed accordingly.
9) **Material of Construction**
   i) The pressure vessels shall be fabricated from carbon steel plates conforms to SA 515 Gr.70 or SA 516 Gr. 70 if the pressure vessels are designed as per ASME Section VIII.
   ii) If the pressure vessels are designed as per IS 2825 following criterion shall be followed: The pressure vessels shall be fabricated of steel as per IS: 2002 Gr. 3 (normalized condition) or SA: 515/516 Gr. 70 (normalized), in case the vessels are designed as per Class 1 or Class 2 of IS: 2825. If the pressure vessels are designed as per Class 3 of IS: 2825, the material of construction shall conform to IS: 2062 or IS: 2002 Gr. 3 (Normalized quality).or SA 515 /516 Gr. 70
   iii) All atmospheric tanks shall be fabricated of steel conforming to IS: 2062.
   iv) The pipe flanges, manhole/manhole covers reinforcement pads etc. shall be fabricated out of the same material as that one used for the vessel/tank.
10) **Fabrication**
   a) The vessel ends for storage tanks of vertical type shall have flat bottom. However, the ends of horizontal storage tanks, and all the pressure vessels shall be dished design of Torispherial type designed and constructed by forging, pressing or spinning. The dished ends shall have a minimum straight flange length of 60 mm. Conical or flat (with or without reinforcement) ends shall not be accepted.
   b) The plates to be used for fabrication shall preferably have a minimum width of 1500 mm. All welding shall be performed by ASME qualified welders under Section-IX

of ASME Boiler and Pressure Vessel code and welding electrodes shall be as per relevant Codes/Standards viz. AISC Section 1.17 etc.

c) All pressure vessels and storage tanks except DM water storage tanks, UF, RO Permeate water tanks shall be fabricated complete and tested at manufacturer's works to ensure better workmanship.

1) **Appurtances, Connections, Lifting lugs**

a) Manholes/Hand Holes: All the pressure vessels and horizontal type storage tanks shall be provided with at least one manhole of 500 mm diameter. The vertical type storage tanks shall be provided with a manhole of 500 mm dia on the top cover, if the diameter of the tank is 1200 mm or more. For the vertical cylindrical atmospheric tanks, manholes shall be provided as per IS: 803.

b) All the vessels and tanks shall be normally provided with a hand hole of 150 mm gasketed located near the bottom of the straight side.

c) All lined vessels connections shall be conformed to required class/rating. Nozzle material shall be ASTM-106 Grade B, Schedule 80.

d) All vessels of internal, diameter of 1200 mm or greater shall be provided with minimum four (4) lifting lugs for safe and effective handling during erection. Smaller vessels shall be provided with at least two (2) lifting lugs. Material of construction for these vessel supports, saddles, lugs shall conform to IS: 2062 of tested quality.

26.00.00 **Painting:** Painting shall be conforming to the requirements specified elsewhere in technical specification.

MRHS Flow Diagram

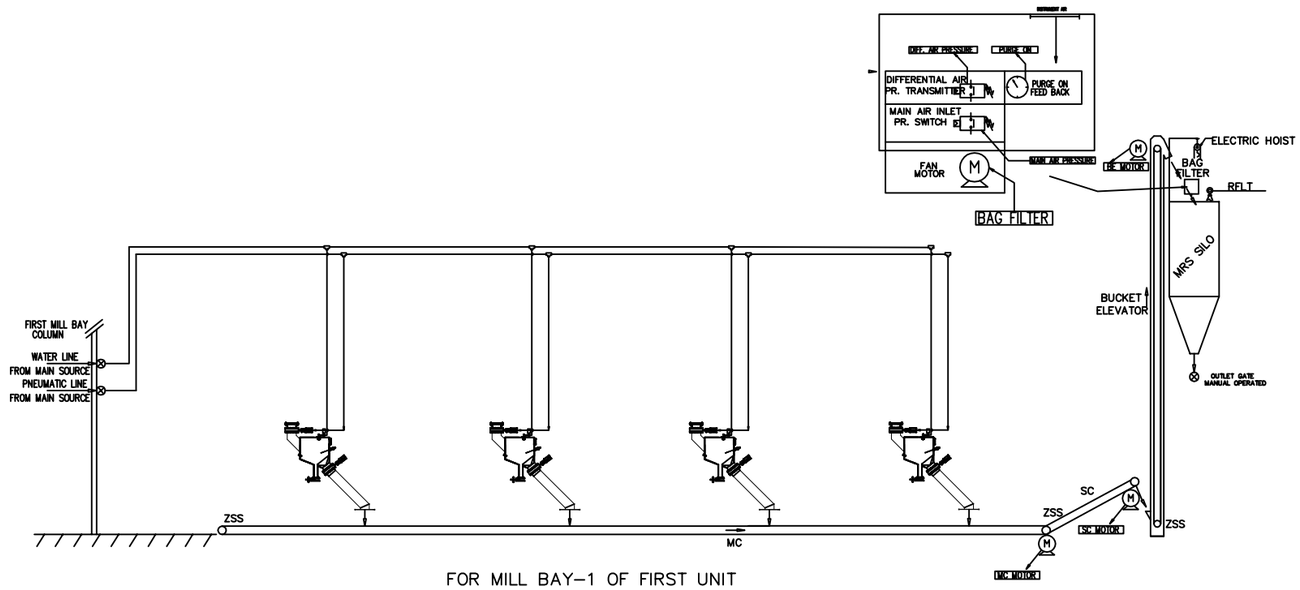
COMPUTER FILE NAME:

DRAWING No. PE-DG-411-160-A001-Rev.0

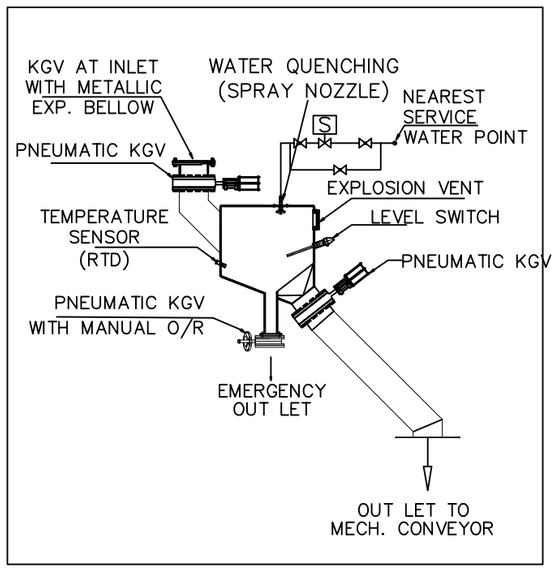
CUSTOMER'S DRAWING No.

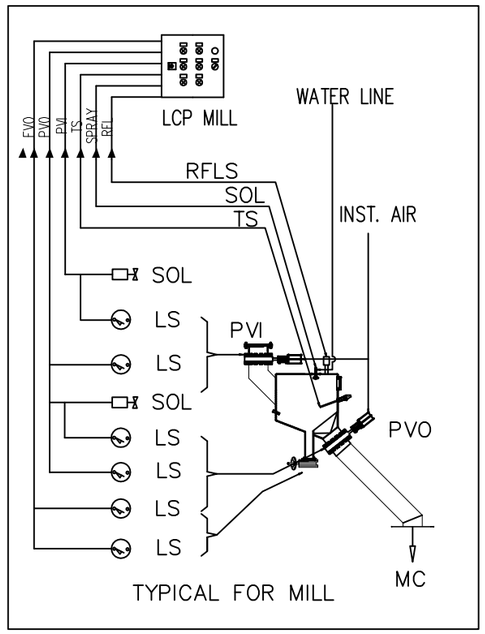
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



FOR MILL BAY–1 OF FIRST UNIT





ALL SOLENOIDS SHALL BE DOUBLE COILED

NOTE :–

1. FOLLOWING PREFIXES TO BE USED FOR KKS TAG No. IN DETAIL DRAWINGS

UNIT NO.	PREFIX
UNIT–1	1
UNIT–2	2
UNIT–COMMON	9

2. THE SCHEME IS TYP. FOR MILL BAY–1 OF FIRST UNIT AND SHALL BE SIMILAR FOR FOR MILL BAY–2 OF FIRST UNIT AND BOTH MILL BAYS OF SECOND UNIT.
3. INSTRUMENTS SHOWN HERE ARE TENTATIVE. ACTUAL REQUIREMENT OF INSTRUMENTS INCLUDING REDUNDANCY SHALL BE GOVERNED BY C&I SPECIFICATION.
4. THE INSTRUMENTATION FURNISHED IN THE PID IS A MINIMUM REQUIREMENT. HOWEVER ANY INSTRUMENT REQUIRED FOR COMPLETENESS OF THE SYSTEM SHALL BE PROVIDED BY BIDDER WITHOUT ANY COST IMPLICATION IMPLICATION. FOR REDUNDANCY CRITERIA, VENDOR TO FOLLOW THE CLAUSE PERTAINING TO REDUNDANCY CRITERIA MENTIONED SPECIFIC TECHNICAL REQUIREMENT.

COMMON LEGEND:

MC – MAIN CONVEYOR
SC – SECONDARY CONVEYOR
LS – LIMIT SWITCH
SOL–SOLENOID VALVE
RFLT–RADIO FREQUENCY LEVEL TRANSMITTER
RFLS–RADIO FREQUENCY LEVEL SWITCH
TS–TEMPERATURE SENSOR (RTD)
ZSS– ZERO SPEED SWITCH
PS– PRESSURE SWITCH
PG– PRESSURE GAUGE
PVI– PYRITE HOPPER INLET VALVE
PVO– PYRITE HOPPER OUTLET VALVE

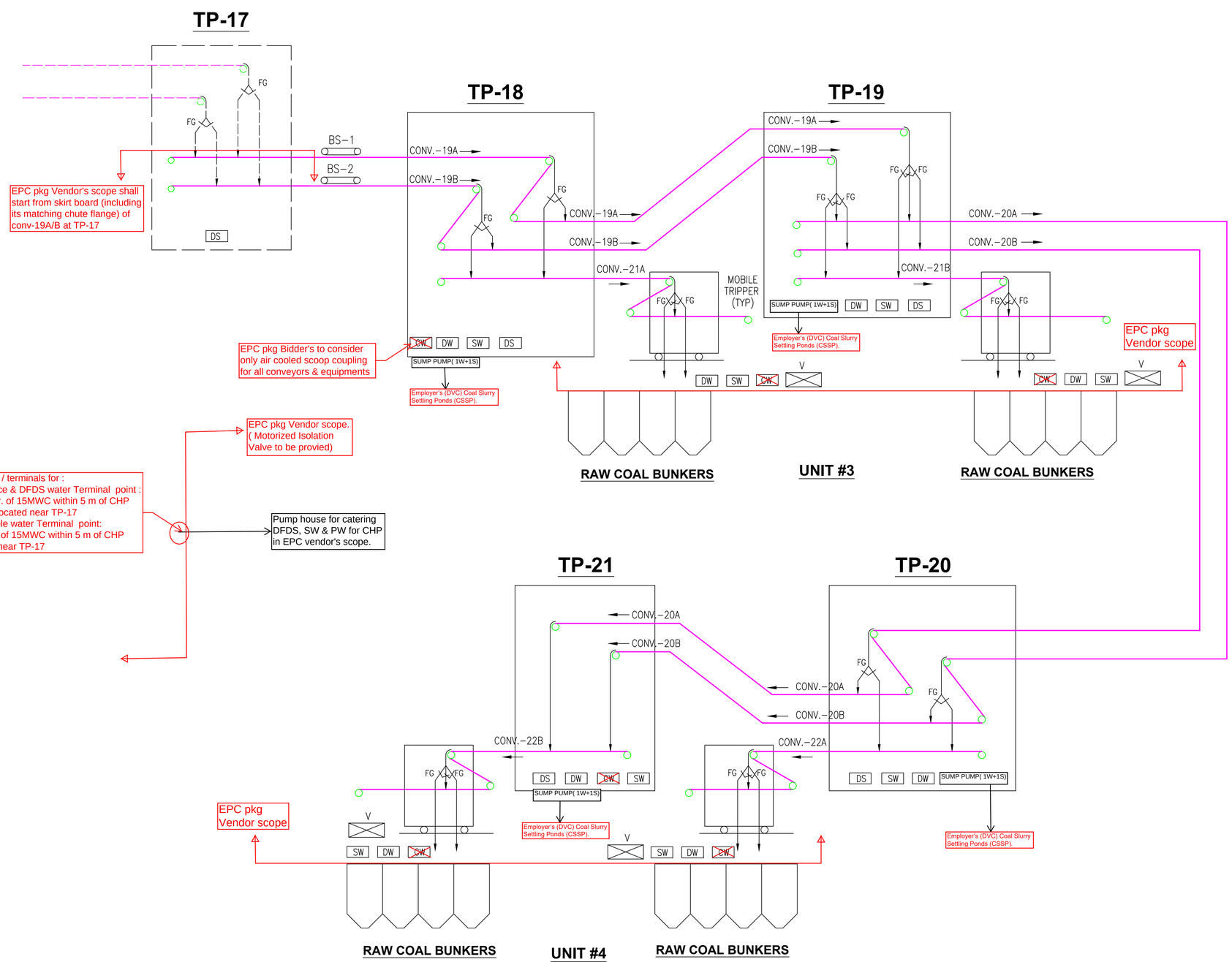
CUSTOMER	DAMODAR VALLEY CORPORATION			
CUSTOMER'S CONSULTANT				
JOB No. 528	RAGHUNATHPUR THERMAL POWER STATION PHASE–II (2x660 MW)			
STATUS CONTRACT				
DISTRIBUTION				
TO	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI	DEPT CODE A	NAME / SIGN / DATE	
No.OFF			DRN RB	10.12.25
REV / DATE / ALTD / CHD / APPD			DESN RB	10.12.25
			CHD VVH	10.12.25
			APPD VVH	10.12.25
	TITLE: FLOW DIAGRAM FOR MILL REJECTS HANDLING SYSTEM			
		DEPT. / SIGN / DATE	SCALE NTS	DRAWING No. PE–DG–528–160–A001
			SHEET 1 OF 1	REV 00

SIZE–A3

Corrigendum - 2 dated 19/12/2025 to CPC Tender No. BHEL/CPC/ RTP/EPC_AHP_CHP/26/051

CHP Flow Diagram

ANNEXURE MH-1
SH 1 of 2



APPLICABLE FOR SIDE MILL ARRANGEMENT

MT	MOBILE TRAVELLING TRIPPERS	4	2000 TPH
DS	DUST SUPPRESSION SYSTEM	LOT	
22A/22B	CONVEYOR 1600 mm WIDE	2	2000 TPH
21A/21B	CONVEYOR 1600 mm WIDE	2	2000 TPH
20A/20B	CONVEYOR 1600 mm WIDE	2	2000 TPH
19A/19B	CONVEYOR 1600 mm WIDE	2	2000 TPH
BS	BELT WEIGH SCALE	2	
FG	FLAP GATE	LOT	

LEGEND		LEGEND		LEGEND	
	BELT FEEDER/REVERSIBLE BELT FEEDER	BS	BELT SCALE	FG	FLAP GATE
DS	DUST SUPPRESSION SYSTEM	CSU	COAL SAMPLING UNIT		ROD GATE
SW	SERVICE WATER SYSTEM	DS	DUST SUPPRESSION–PF		RACK & PINION GATE
DW	DRINKING WATER SYSTEM	ILMS	MAGNETIC SEPARATOR (IN LINE)	CR	CRUSHER
DE	DUST EXTRACTION SYSTEM	MD	METAL DETECTOR	VF	VIBRATING FEEDER
SP	SUMP & SUMP DRAINAGE PUMPS	PF	PADDLE FEEDER	SM	SUSPENDED MAGNET
	BELT CONVEYOR	V	VENTILATION	EL	ELEVATOR

NOT IN BIDDER'S SCOPE

NOTES :

1. THIS DRG. IS MEANT TO SHOW ONLY COAL FLOW PATH AND DOES NOT INDICATE COMPREHENSIVE SCOPE OF WORK. THE NOS. OF TPs SHOWN IS INDICATIVE. BIDDER MAY OPTIMIZE THE LAYOUT MEETING ALL THE FUNCTIONAL AND TECHNICAL REQUIREMENTS.
2. ALL CONVEYORS SHALL BE PROVIDED WITH ACCESSORIES SUCH AS PULL CORD, BELT SWAY AND ZERO SPEED SWITCHES, BELT WIPER UNITS, TENSIONING DEVICES ETC. AS PER TECHNICAL SPECIFICATION. THESE ARE NOT SHOWN IN THE FLOW DIAGRAM FOR CLARITY.
3. 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 INCLUDED IN BIDDER'S SCOPE UNLESS SPECIFICALLY EXCLUDED.
4. DUST SUPPRESSION, SERVICE WATER, POTABLE WATER, COOLING WATER, DUST EXTRACTION & VENTILATION SHALL BE PROVIDED AS PER TECHNICAL SPECIFICATION REQUIREMENT.
5. THIS TENDER DRAWING IS TO BE REVIEWED IN CONJUNCTION WITH THE TECHNICAL SPECIFICATIONS.
6. BIDDER MAY FOLLOW COAL FLOW DIAGRAM IN CASE OF ANY DISCREPANCY IN QUANTITIES.

FOR TENDER PURPOSE ONLY

REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	C	M	E	C&I	APPD	DATE
					CLEARED BY					
	RELEASED FOR TENDER	NAVEEN	RM							

एन टी पी सी NTPC
एन टी पी सी लिमिटेड
NTPC Limited
(A GOVT. OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: RAGHUNATHPUR THERMAL POWER STATION
PHASE–II (2x660MW)

TITLE: STEAM GENERATOR ISLAND PACKAGE
COAL CONVEYING IN MAIN PLANT

SIZE	SCALE	DRG.NO.	REV.
A1	––	XXXX-001A-2-POM-A-032 (Sht-1)	1

CAD FILE NAME : XXXX–001A–2–POM–A–032 .dwg