LARA SUPER THERMAL POWER PROJECT
STAGE-II (2 X 800 MW)

TECHNICAL SPECIFICATION
FOR

GYPSUM DEWATERING EQUIPMENT
(SUB-ASSEMBLY OF FGD)

SPECIFICATION No. PE-TS-508-571-A101

REV NO. 00

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

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PROJECT INFORMATION

SL. NO	DESCRIPTION	UOM	DETAILS
1	**CUSTOMER**	-	**NTPC LTD.**
2	**CUSTOMER CONSULTANT**	-	**NTPC LTD.**
3	**METEOROLOGICAL DATA**	-	
3.1	MAXIMUM TEMPERATURE	℃	48.3
3.2	MINIMUM TEMPERATURE	℃	6.4
3.3	MAXIMUM RELATIVE HUMIDITY	%	84
3.4	MINIMUM RELATIVE HUMIDITY	%	22
3.5	AVERAGE ANNUAL RAINFALL	mm	119.11
3.6	SEISMIC ZONE (AS PER IS 1893)	-	V
3.7	HEIGHT ABOVE MSL	m	220
4	**ELECTRICAL DATA**		
4.1	AMBIENT TEMPERATURE FOR DESIGN OF ELECTRICAL EQUIPMENT	℃	50
4.2	RATED FREQUENCY	Hz	50
4.3	FREQUENCY VARIATION	%	(+) 3 to (-) 5
4.4	AC VOLTAGE	V	415/3300
4.5	AC VOLTAGE VARIATION	%	415 V/240 V: +/-10; 3.3KV: +/- 6%
4.6	DC VOLTAGE	V	-
4.7	DC VOLTAGE VARIATION	%	-
4.8	FAULT LEVEL	KA/sec	Refer Electrical DataSheet

SCOPE

SCOPE OF THIS PACKAGE COVERS THE FOLLOWING:

SL. NO	PARAMETERS	REQUIREMENT
1	Supply Including Design, Engineering, Manufacturing of	
a)	Main Supply	YES
b)	Commissioning Spares	YES
2	Painting	YES
3	Inspection & Testing	YES
4	Packing	YES
5	Transportation & Delivery To Site	YES
6	Erection & Commissioning	NO
7	Supervision of Erection & Commissioning	YES
8	Performance Guarantee (PG) Test	YES
9	Mandatory Spares	YES
10	O & M Service	NO
11	O & M Spares	NO

GENERAL TECHNICAL REQUIREMENT	
1	It is not the intent to specify herein all the details of design and manufacturing. Bidder shall ensure that the offered equipment(s) conforms in all respects to high standards of design, engineering and workmanship.
2	Bidder shall also ensure that the offered equipment shall comply with all applicable statutory and regulatory requirements.
3	In the event of any conflict between the requirements of two clauses of this specification, documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply.
4	Drawing/document submission shall be through web based Document Management System (DMS) of BHEL. Bidder would be provided access to the DMS for drawing/document submission. Bidder to ensure internet connectivity of min speed of 2Mbps at their end.
5	Drawings/ documents submitted by supplier at any stage shall be complete in all respects. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor. For any clarification/ discussion required to complete the drawings, the bidder shall depute his personnel to BHEL / Customer's Office as per the requirement for across the table submission/ finalizations of drawings.
6	Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied after approval by the BHEL / customer.
7	Bidder shall submit Quality Plan on compliance route in the event of order Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
8	In case, the bidder is sourcing the item/any component from outside India, the third party inspection shall be arranged by bidder at their cost and shall be deemed to be considered by the bidder in their offer.
9	Nameplates shall be manufactured from stainless steel or aluminium with a matte or satin finish, and engraved with black lettering of a minimum 6 mm height or as per equipment standard whichever is higher
10	All sub - vendors shall be subject to BHEL/ Customer approval in the event of order.
11	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and International Codes & Standards, especially the Indian Statutory Regulations.
12	Mandatory Spares : Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all the items supplied and installed and the breakup for these shall be furnished in the bid. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the mandatory spare list

GENERAL TECHNICAL REQUIREMENT (C&I)	
1	Control of Gypsum dewatering Equipment (GDWE) shall be through DCS located in FGD Control Room.
2	Bidder shall provide Complete Instrumentation along with necessary fittings, accessories and valve manifold etc. for control, monitoring and operation of entire GDWE except marked as BHEL's scope in P&ID enclosed in specification.
3	Bidder to provide temperature sensor along with temperature transmitter for HT drives i.e. Pump and Motor for bearing and winding temperature measurement. Bidder to also provide TT JB/ Rack & other erection hardware.
4	All transmitters shall be suitably grouped together and mounted inside racks in case of covered area. In case grouping is not possible and transmitter is to be installed individually, canopy with suitable mounting arrangement shall be provided by the bidder. The transmitter racks shall be in Bidder's scope of supply.
5	Diaphragm seal shall be provided with Instruments having contact with corrosive media.
6	The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.
7	Redundancy of sensors shall be provided by bidder (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder.
8	The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. Solenoid Valve shall be rated for 24V DC.
9	230 V AC UPS/415V AC power supply shall be provided by BHEL at a single point. Further distribution to various instruments/equipment of the system shall be in bidder's scope. All necessary hardware/power distribution board for deriving other power supply from given feeders shall be in Bidder's scope. Bidder to furnish UPS load data during detailed engineering.
10	Root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold, junction boxes and all other accessories required for erection of local / remote instruments shall be provided by Vendor. Double root valve to be provided where the design pressure is or more than 40 Kg/cm2.
11	The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes.
12	All instruments other than profibus type shall be terminated in junction boxes. JB are in bidder's scope for bidder's supplied instruments. Number of Junction Boxes shall be sufficient and located suitably in the field to minimize local cabling (max 12-15 mtrs).
13	All the outdoor field instruments such as transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/ panel/ rack so that the equipment are protected against rain/ sunlight etc.
14	All electric actuators, pneumatic control valves, Junction Boxes, Solenoid boxes and Local control panels which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering.
15	Bidder to provide Comprehensive Annual Maintenance Services (AMS) for three (03) years after warranty period for profibus instruments of Gypsum dewatering system.

16	For all Profibus devices GSD and DTM files are to be provided for configuration/ testing in the DCS for proper interfacing and diagnostics.
17	**TYPE TEST GENERAL REQUIREMENT**
17.1	Submission of type test results and certificate shall be acceptable provided:
17.2	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.
17.3	There has been no change in the components from the offered equipment & tested equipment.
17.4	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
17.5	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.
17.6	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
17.7	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording, precautions to be taken etc. for the tests to be carried out.
18	**ANNUAL MAINTENANCE SERVICE (AMS) FOR PROFIBUS INSTRUMENTS**
18.1	The requirements specified below are applicable for warranty (defect liability period) and 3 years AMS period.
18.2	The Contractor's scope shall also include providing Post Warranty Maintenance for 3 years after completion of warranty period of the offered profibus systems and all associated components as per specification. The AMS shall include tools and tackle as required; travel, boarding & lodging of service engineer. In the event of any malfunction of the system hardware/system software, experienced service engineer shall be made available at site within 48 hours on the receipt of such information from Employer.
18.3	Employer personnel will work on system day-to-day basis and wherever possible, Employer shall inform the type of failure of hardware/ software to Contractor based on diagnostic available with the system. However Contractor shall be fully responsible to attend and rectify the root cause and the failure within 48 hrs. Contractor may utilize the spares available with Employer, if necessary and available with Employer at site, which are part of mandatory spares supplied with system as per this specification. However, the consumed spares shallbe replenished to Employer within 2 months' time.
18.3	**The services under Post Warranty Maintenance Agreement, shall broadly comprise of the following:**
18.3.1	Periodic Maintenance Site visits, minimum four (4) times in a year (total days expected 16 in a year), schedule of visits to be discussed and finalized jointly between Contractor and client after placement of order/ delivery. It shall include inspection of general healthiness of the system, study and advice on daily maintenance, inspection of Hardware & Software, if any problem is reported, running of test programs, on-line servicing and solving reported problems. System shall be checked online.

18.3.2	Software Maintenance/ Support Contractor shall maintain the existing operating & application software for any debugging requirements to have consistent performance of the system.
18.3.4	Contractor shall note that while carrying out the Annual Maintenance Contract activities, Employer's engineers shall associate with the Contractor. On-job training of these associated engineers shall be covered under this scope. This shall include all items being supplied by Contractor, including any bought out items but not limited to the following: Labour, at no additional cost, to repair any system devices , to provide tests, and adjustment to system devices.

SPECIFIC TECHNICAL REQUIREMENT	
1.1	**PROCESS DESCRIPTION**
1	A common Gypsum Dewatering Equipment (GDWE) is envisaged for both units. The dewatering equipment shall receive the gypsum slurry from Primary Hydro cyclone feed pumps (BHEL Scope).
2	The overflow from the primary sets of hydro-cyclone shall be taken to a secondary hydro-cyclone feed tank (BHEL Scope). Secondary Hydro cyclone feed pumps (BHEL Scope) shall transfer the slurry from tanks to secondary hydro cyclone. Two sets of Secondary hydro cyclones (1 working+1 stand by) and its accessories shall be in bidder scope.
3	The underflow from the secondary hydro-cyclone shall be taken to the filtrate water tank. The over flow from the secondary hydro-cyclone shall be taken to a waste water storage tank.
4	Two nos. of belt filter/ cloth wash tanks & Two nos. of cake wash tanks along with rubber lining (BHEL Scope) are envisaged. Each tank shall be provided with 2x100% of pumps along with complete washing arrangement (bidder scope).
1.2 (A)	**TERMINAL POINTS**
1	Primary hydro cyclone feed slurry will be provided by BHEL at the inlet flange of the primary hydro cyclone.
2	Primary hydro cyclone overflow launder outlet flange. Further piping by BHEL to secondary hydrocyclone feed tank.
3	Secondary hydro cyclone feed slurry will be provided by BHEL at the inlet flange of secondary hydro cyclone.
4	Secondary hydro cyclone underflow launder outlet flange and overflow launder outlet flange. Further piping by BHEL to waste water and filtrate tank.
5	Outlet at vacuum receiver and TP near VBF for other drain of such as cloth wash, dyke drain etc.
6	Process water & instrument air will be provided at one location, located at 5m from building boundary. Further piping from terminal point to GDW Equipment utilities is in bidder's scope.
7	VBF Discharge outlet flange for Gypsum discharge is in bidder's scope. Please refer enclosed P&IDs, typical layout & preliminary elevation drawing of GDWE building for the details in the scope.
1.2 (A)	**PIPING, VALVES AND ACCESSORIES**
(i)	Complete engineering and supply of interconnected piping (slurry, air and water pipes) along with valves, rubber lining (wherever applicable, shall be supplied in erectable condition i.e., no rubber lining to be done at Site), instruments, valves, supports, gaskets, fasteners and accessories which is integral to Gypsum Dewatering Equipment – One (1) set* which is broadly defined below:
a	Slurry piping from Primary hydro cyclones underflow to Vacuum Belt Filters

b	Filtrate piping from Vacuum belt filters to Vacuum receivers and further up to the extraction pumps discharge.
c	Air piping from vacuum receivers to vacuum pumps to atmosphere
d	Vacuum pumps seal water / drain water pipes to/ from wash tanks. Supply of seal water to vacuum pumps shall be provided through clarified water pump as specified in P & ID. Seal water drain from vacuum pump shall be collected in sump pit and shall be routed back to clarified water tank through seal water sump pump.
e	Process/clarified water piping from TP outside building to wash tanks.
f	Instrument air piping from TP outside building up to equipment related to the system.
(ii)	Scope of below-mentioned interconnected piping (slurry, air and water pipes) along with valves, rubber lining (wherever applicable), instruments, valves, supports, gaskets, fasteners and accessories which is non-integral to Gypsum Dewatering Equipment is
a	Primary hydro cyclone feed tank outlet to the inlet flange of Primary hydro cyclones along with recirculation piping to feed tank
b	Primary hydro cyclones over flow to Inlet of secondary hydro cyclone feed tank
c	Secondary hydro cyclone feed tank outlet to inlet flange of secondary hydro cyclones along with recirculation piping to feed tank
d	Secondary hydro cyclones underflow to filtrate tank
e	Secondary hydro cyclones overflow to inlet flange of wastewater tank
f	Vacuum receiver drain through filtrate extraction pumps (bidder scope) to Filtrate tank and other associated drains of vacuum belt filters to filtrate tank
g	g. Overflow and drain piping of cake wash tanks and cloth wash tanks.
1.3	**BRIEF DETAILS OF THE SYSTEM AND COMPONENTS**
1.3.1	Bidder shall supply two stage GDWE (2x100%) for dewatering of gypsum slurry bled from absorber tank to less than 10% moisture at the design capacity specified elsewhere in the specification.
1.4	**Hydro-cyclones**
1.4.1	Each set of primary hydro-cyclone shall be installed directly above the respective vacuum belt filters. The overflow of the hydro-cyclones shall be taken to Hydro-cyclone Waste Water tank via secondary hydro-cyclone feed tank and secondary waste water hydro cyclone as shown in the relevant P&ID..
1.4.2	Each set of primary hydro-cyclone shall be provided with 10% spare hydro-cyclones. The capacity defined in the previous clause shall be met with spare hydro-cyclones out of service
1.4.3	Both primary and secondary hydro-cyclones shall be of modular construction. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Individual isolation valve shall be provided for each hydro-cyclone for this purpose.
1.4.4	The hydro-cyclone shall be of proven design The primary hydro-cyclone shall me made up of made of polyurethane, urethane or with replaceable rubber lining. The feed chamber shall be provided with a minimum lining thickness of 12 mm. The liners shall have a minimum wear life of not less than 8000 hrs.

1.4.5	Each set of hydro-cyclone shall be sized to process the maximum discharge from the secondary hydro-cyclone feed pumps. A minimum 10% spare hydro-cyclones shall be provided in each set. Hydro-cyclones shall be of modular construction and of proven design. The secondary hydro-cyclone shall be made up of polyurethane or urethane materials or replaceable rubber lining. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Individual isolation valve shall be provided for each hydro-cyclone for this purpose.
1.5	**Vacuum Belt Filters**
1.5.1	Two (2) numbers of vacuum belt filters each of capacity **47.9 TPH (Wet cake)** at the outlet of each VBF are envisaged. Each vacuum belt filter shall be sized to meet the following requirements, all occurring together, with an inlet solid concentration of not more than 45% or outlet of hydro-cyclones whichever is minimum:
	(i) Outlet Moisture: 10% (maximum)
	(ii) Chloride content: < 100 ppm
1.5.2	The Vacuum Belt Filters shall have the following characteristics:
	a) Very rigid frame and rolls, no deformation whatsoever may occur.
	b) All rolls shall be installed perfectly horizontally.
	c) There shall be no vacuum under the slurry deposition zone.
	d) Deposit thickness control and directional stability control.
	e) The slurry shall be put on the belt in counter current relative to the rotation of the band.
	f) The vacuum chambers shall be easily opened for inspection and cleaning.
1.5.3	The filter cloth shall be polyester or polypropylene as per the proven design of the supplier and shall be guaranteed for **a minimum life of not less than 7000 hours**.
	In case the bidder does not stand guarantee for specified life, they shall supply additional sets of filter cloth(s) to meet the **cumulative life of 7000 hours**. The same is applicable for main as well as mandatory spares and shall be supplied along with main supplies and mandatory spares.
1.5.4	The complete frame of the filter and all parts in contact with gypsum shall be made of corrosion resistant material (such as Corten Steel, SS304 etc.) or shall be provided with corrosion resistant liners of proven design.
1.5.5	In case, the contractor offers a design with an underlying belt for carrying the filter cloth, the same shall be endless, factory vulcanized rubber belts. The belt shrouds and the sealing belts shall provide a leak tight arrangement to prevent overflow of gypsum slurry. The sealing belt shall have **minimum life of not less than 7000 hours**.
	In case the bidder does not stand guarantee for specified life, they shall supply additional sets of wear belt(s) to meet the cumulative life of 7000 hours. The same is applicable for main as well as mandatory spares and shall be supplied along with main supplies and mandatory spares.
1.5.6	The vacuum box shall ensure tight sealing with the belt/cloth and shall be of proven design.

1.5.7	The belt filter shall have an automatic cloth tracking mechanism and shall be provided with all required instrumentation as per the bidder's proven practice. The belt filter shall have an automatic cloth tensioning mechanism. Pull chord switches shall be provided for each vacuum belt filter. Two (02) no.'s of Belt sway switches shall be provided for each vacuum belt filter. Cake thickness sensors with double redundancy shall be provided for each vacuum belt filter which shall control the speed of the vacuum belt filter in turn.
1.5.8	Differential Pressure indicator shall be provided at the discharge line of Belt filter wash Pump for each vacuum Belt filter. Flow indicator shall be provided for cloth washing line of each vacuum belt filter. Flow indicator shall be provided for cake washing line of each vacuum belt filter as per enclosed P&ID .
1.5.9	The filtrate from gypsum slurry and from cake washing shall be taken to a common or separate vacuum receiver tank(s) as per the proven practice of the supplier. Each belt filter shall have an independent vacuum pump.
1.5.10	The filtrate from gypsum slurry and from cake washing shall be taken to a separate vacuum receiver tank(s) as per the proven practice of the supplier. Each belt filter shall have an independent vacuum pump.
1.5.11	Gypsum cake from each belt filter shall be discharged through a hopper onto belt conveyor being provided by the Employer. Hopper means discharge chute only, Gypsum cake from each belt filter shall be discharged through a chute arrangement onto belt conveyor indicated in GA drawing.
1.5.12	A 2000 mm wide floor/ platform shall be provided all around each belt filter for easy approach & maintenance or it may provide a common platform of **3.3 m** (approx.) width. In case, common platform for VBF is provided, a movable platform along with access ladder shall be provided for approaching components on other side of VBF. The elevation of discharge point of vacuum belt filter shall be as per the Gypsum Dewatering Building Drawing provided for compliance.
1.5.13.	The service factor of the gear unit (if any) shall be minimum 1.5.
1.5.14	Piping and wiring within the skid should be in the supplier's scope.
1.5.15	All client end connection flanges shall be ANSI B 16.5 / AWWA.
1.5.16	All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality The Contractor can provide slurry pipes size up to 400 NB made up of FRP material as per ASTM 2310 and testing as per ASTM B2583(silicon carbide coating on slurry exposed surface)if it has previous experience of providing the same. Outer surface of the pipes should be fire retardant. If it has previous experience of providing the same.
1.6	**Vacuum System**
1.6.1	The filtrate from each belt filter, cake washing & cloth washing shall be taken to separate receiver tank(s) as per the supplier's proven practice. Each belt filter shall be provided with an independent vacuum pump sized to meet the requirements of the belt filter operating at its maximum capacity. An additional 10% margin over the above shall be provided in each vacuum pump.

1.6.2	Each Vacuum pump shall have its own piping system, which connects the pump with the associated vacuum belt filter. Bidder to provide Equipment layout and General Arrangement (GA) of Gypsum dewatering building along with the offer.
1.6.3	The vacuum pump shall be of low speed liquid ring type of proven design. The design of the vacuum pumps shall avoid cavitation under all operating conditions. The seals shall be of proven design.
1.6.4	Silencers shall be provided, if required, to limit the noise level to values stipulated elsewhere in this specification.
1.6.5	The vacuum receiver and pump internals shall be suitably lined to protect against the corrosive environment. The material selected for vacuum pumps & vacuum receivers shall be proven for similar application and shall be subject to approval of BHEL/Customer.
1.6.6	Each vacuum receiver tank(s) shall be provided with slide plate type pneumatic vacuum breaker. The plate shall be stainless steel with a min. thickness of 3 mm.
1.7	**Common requirements for pumps (Vacuum pump, Filtrate belt filter, Cake wash)**
1.7.1	All the pump wear parts in contact with the slurry shall be provided with replaceable rubber / elastomer liners suitable for the fluid handled. The bidder can also offer a hi-chrome alloy lined pump if proven for similar applications.
1.7.2	All the slurry pumps (if applicable) shall be provided with motorized / pneumatic suction and discharge valves as per bidder's proven practice. In addition, flushing water lines with motorized/ pneumatic valves shall be provided for each pump for automatic flushing of the pump after each shut down. The flushing water for the pumps shall be taken from the process water supply. The process water lines shall be provided with pneumatic/motorized valves as per the proven practice of the Bidder.
1.7.3	The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption. The shaft shall be supported on heavy-duty ball/ roller bearings.
1.7.4	The pumps shall have mechanical seals of cartridge type with self-lubrication sliding ring cartridges. The static part will be mounted on the seal plate with circumferential ring (O-ring) or another flexible sealing ring. Built in seal design will not be accepted.
1.7.5	Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate. The NPSH Values are to be referred to the least favorable operating conditions- lowest atmospheric pressure, lowest level of water on the suction side of the pump and highest temperature of the pumped fluid. An adequate safety margin of normally greater than 1 m to the max NPSH required shall be provided.
1.7.6	All pumps shall be fitted with suction and discharge pressure gauges. The gauges shall be with diaphragm seal for slurry application and shall be with gate valves for other medium. All the wetted parts shall be SS 316 or equivalent.

1.7.7	Venting valve shall be fitted to all pumps at suitable points on the pump casing unless the pump is self-venting due to the arrangement of the suction and discharge nozzles. Drainage facilities shall be provided on the pump casing or adjacent pipe work to facilitate the dismantling of pumps.
1.7.8	Design pumps not to be damaged during reverse rotation at up to 150% of design RPM, at full discharge head in the event that a pump trips while the other operating pump remain on line.
1.7.9	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off. Shut-off head should be 115% of Best Efficiency Point (BEP).
1.7.10	Selection of Duty point should preferably be at BEP (Best Efficiency Point) or slightly at the left of BEP. Selection of Duty point beyond 115% of BEP will not be acceptable. It should be noted that head variation is due to level variation in tank. Pump has to run in the system without compromising its NPSH requirement at lowest water level in tank. Hence, when tanks are filled-up and are at normal water level, pump will operate at the right of BEP, pump's operating zone should be considered accordingly.
1.7.11	Pump should have adjustment provision of axial clearance between casing and impeller for maintenance of performance at best efficiency when there is wear in between impeller and casing.
1.7.12	In case rubber or non-metallic linings are used, these will be two piece moulded under pressure and adjusted to the screwed metallic clamping which have been welded to the casting.
1.7.13	Each pump will have a coupling of adequate size, designed for full load and capable of supporting start-up on overload moments. Each half of the coupling will be factory mounted and locked to its shaft. The coupling must be able to accept the adjustment of the impeller.
1.7.14	Pump induced vibration due to flow pulsations shall be avoided through suitable design.
1.7.15	Each rotating equipment shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).
1.7.16	The material and thickness of the liners of slurry pumps, if applicable shall ensure a minimum service life of 24000 Hours before replacement. All the wear parts of the pump shall be **guaranteed for a minimum wear life of not less than 14000 hours (if applicable).**
1.7.17	Coupling halves shall be machine matched to ensure accurate alignment. Couplings must have a rated capacity of at least 120% of the maximum potential power transmission requirement.
1.7.18	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type. Coupling shall be of flexible type made of cast steel. The bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the pump and the motor by bidder. The coupling between shafts shall be so designed that they become tight during pump operation.

1.7.19	A common base plate shall be provided for pump assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting pump.
1.7.20	Pump manufacturer is to supply base plate along with Foundation bolt & Nut, “Taper wedge” and the necessary fastener for Pump and Motor with Base plate.
1.7.21	All equipments shall be provided with name plates (304 Stainless steel plate) indicating the item number and service name.
1.7.22	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
1.7.23	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
1.7.24	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
1.7.25	Two pieces of stainless-steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
1.7.26	Provide double nuts for anchor bolts.
1.7.27	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
1.7.28	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
1.7.29	Bidder shall provide the mating flanges with the necessary gaskets.
1.7.30	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
1.7.31	Bidder to provide the details of heaviest component for safe material handling.
1.7.32	Bidder to provide Pipe & Valve Material as per the of the Specification.
1.7.33	A 1000 mm wide platform with suitable approach shall be provided by the bidder for each hydro cyclone.
1.7.34	A 1500 mm space around all the pumps shall be provided by the bidder.
1.7.35	Equipments requiring monitoring during regular operation shall be approachable from the ground floor through staircase. Staircase with minimum width of 1200 mm shall be provided for approach to elevated structures at 5 m height from the nearest platform. Below this height, a vertical ladder with minimum clear width of 600 mm may also be acceptable.
1.7.36	The list of all Bought out items with makes and country of origin and contact details of the manufacturers to be mentioned along with offer to be submitted. Acceptance of makes shall be subject to BHEL’s Customer’s acceptance during the detailed engineering without cost and delivery implication to BHEL.

1.8	**Special Tools & Tackles:**
1.8.1	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag/ item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools. List shall be furnished by bidder along with bid.
1.9	**First Fill of Consumables**
1.9.1	Bidder's scope shall include supply and filling of all chemicals, lubricants, grease, filters and consumable items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.
1.9.2	Bidder shall also supply a quantity not less than 10% of the full charge or One (1) year of top-up requirement (whichever is higher) of each variety of lubricants, servo fluids, gases, chemicals etc. (as applicable) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.
1.9.3	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the Customer/ BHEL's approval herein shall be furnished within 2 months of placement of Order. On completion of erection, complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.

TECHNICAL DATA - PART - A (MECHANICAL)

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**DESIGN CODES & STANDARDS**		
1.1	Primary And Secondary Hydro-Cyclone	-	OEM Design, as per specification. Latest applicable Indian / International (ASME/ EN/ Japanese) Standards
1.2	Vacuum Belt Filters (VBF)	-	
1.3	Vacuum Receiver Tank	-	
1.4	Vacuum Pumps	-	
1.5	Slurry Pipes	-	
1.6	Belt Filter/ Cloth Wash Pumps	-	
1.7	Cake Wash Pumps	-	
1.8	Pulleys for VBF	-	
1.9	Discharge Chutes and Hoppers	-	
2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	Quantity of Gypsum De-Watering Equipment	Sets	2 (1W + 1S)
2.2	Capacity of the Gypsum De-Watering Equipment	TPH	≥ 47.9 (Wet cake)
2.3	Moisture content	%	10 (Maximum)
2.4	Chloride content	ppm	<100
2.5	Gypsum purity (By BHEL)	%	90 (Minimum)
3.0	**CONSTRUCTION FEATURES**		
3.1	Primary And Secondary Hydro-Cyclone	-	Proven design in operation for similar capacities
3.2	Vacuum Belt Filters (VBF)	-	
3.3	Vacuum Receiver Tank	-	
3.4	Vacuum Pumps	-	
3.5	Slurry Pipes	-	
3.6	Belt Filter Wash Pumps	-	
3.7	Cake Wash Pumps	-	
3.8	Pulleys for VBF	-	
3.9	Discharge Chutes and Hoppers	-	
4.0	**PERFORMANCE PARAMETERS**		
4.1	ASME PTC 40 code	-	Refer cl no 2.0 above
5.0	**INSPECTION/TESTING**		
5.1	As defined in MQP	-	Bidder shall submit MQP for BHEL / Customer approval.

TECHNICAL DATA - PART - A (ELECTRICAL)

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**DESIGN CODES & STANDARDS**		
1.1	Three phase induction motors :		IS15999, IEC:60034, IS: 12615, IS: 325
1.2	Single phase AC motors		IS:996, IEC:60034
1.3	Energy Efficient motors		IS 12615, IEC:60034-30
1.4	Crane duty motors		IS:3177, IS/IEC:60034
1.5	Mechanical Vibration of Rotating Electrical Machines with Shaft Heights 56 mm and Higher - Measurement, Evaluation and Limits of Vibration Severity		IS 12075/IEC 60034-14
1.6	Designation of Methods of Cooling of Rotating Electrical Machines		IS 6362
1.7	Designation for types of construction and mounting arrangement of rotating electrical machines		IS 2253

2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	Rated voltage	V	a) 415 V b) 3300 V
2.2	Frequency	Hz	50
2.3	Permissible variations for		
a)	Voltage	%	a) 415 V/240 V: +/-10 b) 3.3KV: +/- 6%
b)	Frequency	%	(+)3 to (-)5
c)	Combined	%	10 (absolute sum)
2.4	System fault level at rated voltage for 1 sec	kA	a) 415 V systems - 50 kA rms b) 3.3 KV systems - 40 kA rms
2.5	Short time rating for terminal boxes		50
2.6	Type of motors		Motors with rating equal to or greater than 200KW and upto 1500KW shall be 3 phase, 3.3 kV AC. 'a) Squirrel cage induction motor suitable for direct-on-line starting (for non- VFD motors). b) Motor operating through VFD shall be suitable for inverter duty with VPI insulation.
2.7	Efficiency class		a) Continuous duty LT motors upto 50 KW Output rating (at 50 deg.C ambient temperature), shall be super Premium Efficiency class-IE4, 50-200 KW shall be of Premium Efficiency class – IE3,conforming toIS 12615, or IEC:60034-30. b) HT motors shall have minimum design efficiency of 95 %. However, tolerance on this efficiency value shall be applicable as per IEC 60034.
2.8	TEMPERATURE RISE		a) Air cooled motors - 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. b) Water cooled - 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.
2.9	Rating		
a)	Motor duty		Continuously rated (S1).
b)	Design margin over continous max. demand of the driven equipment (min)		10%
3.0	**CONSTRUCTION FEATURES**		
3.1	Winding and Insulation		Electrolytic grade Copper conductor, Non-hygroscopic, oil resistant, flame resistant Insulation.
3.2	Enclosure Details		
a)	Degree of protection		
	i) Indoor motors		IP 55
	ii) Outdoor motors		IP 55 (Additional Canopy to be provided)

b)	Method of ventilation		Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor.The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6.
3.3	Insulation		a) 415 V systems - Class 'F' with temperature rise limited to class 'B'. Non-hygroscopic, oil resistant, flame resistant Insulation. b) 3.3 KV systems - Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. c) Motors rated above 1000KW shall have insulated bearings/housing to prevent flow of shaft currents. d) Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
3.4	Bearings		Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined thrust and guide beaing for Vertical motors. In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with 3 numbers duplex RTDs connected to three numbers dual input transmitters with display. However, for air compressor, being high speed drive, each motor bearing shall be provided with minimum two numbers of duplex RTDs connected to two numbers dual input transmitters with display unit.
3.5	Main terminal box		
a)	Type		-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. '- 3.3/6.6 KV motors shall be offered with dust tight phase segregated double walled (metallic as well as insulated barrier) Terminal box. Contractor shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. '- Cable size for motor shall be informed during contract stage, which can be higher than the standard rated capacity. Vendor to comply the same.
b)	DOP		Same as motor
c)	Position when viewed from the non driving end		Left hand side
d)	Rotation		90 Deg.

e)	Space heater		Motors rated 30KW and above shall have space heater suitable for 240V, 50 Hz single phase AC supply. Separate terminal box for space heaters & RTDs shall be provided.
f)	Cable glands and lugs		-Motor terminal box shall be furnished with Solder less crimping type heavy duty Lugs (aluminium lugs for aluminium cables and copper lugs for copper cables) and double compression Ni-Cr plated brass glands to match with cable used. -Gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
g)	Minimum clearances to be provided between phase to phase and phase to earth	mm	25
3.6	Earthing points suitable for connection		Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
3.7	Paint shade (Corrosion proof paints of colour shade)		RAL 5012 (Blue) The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However, in case electrostatic process of painting is offered. minimum paint thickness of 50 microns shall be acceptable for finish coat.Epoxy based paint with suitable additives shall be used.
3.8	The Minimum spacing between gland plate & centre of bottom terminal stud		
a)	UP to 3 KW-	mm	As per manufacturer's practice.
b)	Above 3 KW - upto 7 KW	mm	85
c)	Above 7 KW - upto 13 KW	mm	115
d)	Above 13 KW - upto 24 KW	mm	167
e)	Above 24 KW - upto 37 KW	mm	196
f)	Above 37 KW - upto 55 KW	mm	249
g)	Above 55 KW - upto 90 KW	mm	277
h)	Above 90 KW - upto 125 KW	mm	331
i)	Above 125 KW-below 200 KW	mm	203
j)	Above 200 KW	mm	500
k)	For HT motor	**mm**	For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.
3.9	Minimum inter-phase and phase-earth air clearances with lugs installed		
a)	UP to 110 KW	mm	10
b)	Above 110 KW and upto 150 KW	mm	12.5
c)	Above 150 KW	mm	19
4.0	**PERFORMANCE PARAMETERS**		
4.1	Starting requirement		
a)	Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed		a) Up to 85% of rated voltage for ratings below 110 KW b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW
b)	Maximum locked rotor current		as per IS 12615

c)	Starting duty		Two hot starts in succession, with motor initially at normal running temperature.
d)	The locked rotor withstand time under hot condition at highest		
	for motors with starting time upto 20 secs. at minimum permissible voltage during starting		Atleast 2.5 secs. more than starting time
	for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting		Atleast 5 secs. more than starting time
	For motors with starting time more than 45 secs.at minimum permissible voltage during starting		More than starting time by at least 10% of the starting time
			Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
e)	The ratio of locked rotor KVA at rated voltage to rated KW		
	From 50KW & upto 110KW		11
	From 110 KW & upto 200 KW		9
	Above 200 KW & upto 1000KW		10
	Above 1001 KW & upto 4000KW		9
4.2	Torque (percent of full load torque)		a) Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. b) Pull out torque at rated voltage shall not be less than 205% of full load torque.
4.3	Noise level (max.)		85 dB(A)
4.4	Vibration shall be limited within the limits		As per IS:12075 Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
5.0	**INSPECTION/TESTING**		
5.1	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.		
5.2	**Type Test**		
5.2.1	**HT Motors**		
	LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor. Charges for these shall be deemed to be included in the equipment price.		The supplier shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The type tests shall be carried out in presence of the BHEL/Customer representative, for which minimum 07 days notice shall be given by the supplier. The supplier shall obtain the BHEL/Customer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
(i)	No load saturation and loss curves upto approximately 115% of rated voltage		
(ii)	Measurement of noise at no load.		
(iii)	Momentary excess torque test (subject to test bed constraint).		
(iv)	Full load test (subject to test bed constraint)		
(v)	Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.		

B)	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor		The supplier shall only submit the reports of the type tests as listed in & carried out within 10 years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the supplier is not able to submit report of the type test(s) conducted within 10 years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the supplier shall conduct all such tests under this contract at no additional cost to the BHEL either at third party lab or in presence of BHEL/Customer representative and submit the reports for approval.
(i)	Degree of protection test for the enclosure followed by IR, HV and no load run test.		
(ii)	Terminal box-fault level withstand test for each type of terminal box of HT motors only.		
(iii)	Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15		
(iv)	Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15		
5.2.2	**LT Motors**		
	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED		The supplier shall only submit the reports of the type tests as listed in & carried out within 10 years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the supplier is not able to submit report of the type test(s) conducted within 10 years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the supplier shall conduct all such tests under this contract at no additional cost to the BHEL either at third party lab or in presence of BHEL/Customer representative and submit the reports for approval.
	The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only		
(i)	Measurement of resistance of windings of stator and wound rotor.		
(ii)	No load test at rated voltage to determine input current power and speed		
(iii)	Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)		
(iv)	Full load test to determine efficiency power factor and slip		
(v)	Temperature rise test		
(vi)	Momentary excess torque test.		
(vii)	High voltage test		
(viii)	Test for vibration severity of motor.		
(ix)	Test for noise levels of motor		
(x)	Test for degree of protection and		
(xi)	Overspeed test.		

TECHNICAL DATA - PART - A (C&I)			
SL.NO	**DESCRIPTION**	**UOM**	**DETAIL**
1.0	**DESIGN CODES & STANDARDS**		
1.1	Impulse pipes, tubes (material, rating)		ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
1.2	Valves (material, pr. Class, size)		ASTM A182/ASTM A105 as per ASME 16.34
1.3	Fittings (size, rating, material)		ANSI B31.1, ANSI B31.1a, ASME B16.11
1.4	Installation schemes		BS 6739-2009, ANSI/ISA 77.70
1.5	Actuator		EN15714-2
1.6	Fieldbus concepts		IEC 61158
1.7	Instruments and apparatus for pressure measurement		ASME PTC 19.2
1.8	Electronic transmitters		BS-6447, IEC-60770

1.9	Bourdon tube pressure and vacuum gauges		IS-3624
1.13	Colors for ready mixed paints and enamels.		IS-5
1.16	Circuit breaker for household and similar installations.		IS-8828
1.18	Annunciator Sequences and Specification		ISA-18.1
1.21	Instrument and apparatus for temperature measurement		ASME PTC 19.3
1.22	Temperature measurement by electrical Resistance thermometers		IS:2806
1.23	RTD Sensor		IEC-751/ DIN-43760
1.24	Type of Enclosures		NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13)
1.25	Racks, panels and associated equipment		EIA : RS - 310 C- 1983 (ANSI C83.9 - 1972)
1.26	Protection class for enclosures, cabinets, control panels & desks		IS:2147 -1962
1.27	Limit Switch		EN 60947-5-2 or equivalent.
1.28	Modulating duty electric actuator		EN 15714-2 Class D or equivalent
1.29	**Codes for Orifice plate Design**		
	Orifice plate		ISO 5167
	Flange Standard for Orifice plate		ASME B16.36
1.30	**Codes for VFD Design**		
	Bushing		IS: 2099, IEC 60137
	Adjustable Speed Electrical Power Drive Systems		IEC 61800
	Semiconductor converters–General requirements		IEC 60146
	IEEE Recommended practices and requirements for harmonic control in electrical power systems		IEEE 519
	Degrees of protection provided by enclosures (IP Code)		IEC 60529
	Electrostatic immunity test		IEC1000-4-2
	Fast transient immunity test		IEC1000-4-4
	Surge immunity test		IEC1000-4-5
	AC electricity meters		IS: 722
	Metal oxide surge arrestor without gap for AC system		IEC: 60099-4
	Terminal blocks for copper conductors		IEC: 60947-7-1
	Motor		IS:15999, IEC-60034, IEC60034 / NEMA 30 & 31
	Contactor/Switches/Fuses etc.		IEC:60947, IS: 13947
	Harmonics & EM compatibility		IEEE:519/IEC: 61000
	VFD		IEC: 60034/ IEC: 61800
2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	**DATASHEET - PRESSURE TRANSMITTER, DIFFERENTIAL PRESSURE TRANSMITTER, DP BASED FLOW AND LEVEL TRANSMITTER**		
	Output		Profibus PA complying to IEC 61158, digital output
	Turndown ratio		50:1
	Accuracy	%	0.06%
	Stability (% of calibrated range)	%	+/-0.25% for 10 year
	Diaphragm seal material		Suitable for process fluid
	Diagram fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Housing		Metallic housing with durable corrosion resistant coating
	Protection		Weather proof IP-67
	Display		Integral digital display

	Diagnostic feature		Required
	Electrical connection		1/2" NPT (f)
	Manifold		2/3 valve non integral manifold for PT and 5 valve non integral manifold for DPT
2.2	**DATASHEET - PRESSURE GAUGE, DIFFERENTIAL PRESSURE GAUGE**		
	Sensing element		Bourdon for high pressure, diaphragm/bellow for low pressure
	Sensing element material		SS316
	Movement material		SS316
	Body material		SS316
	Dial size	mm	150
	End connection	inch	1/2 inch NPT (m)
	Accuracy		±1% of span
	Scale		Linear, 270° arc graduated in metric units
	Range selection	%	Cover 125% of max. of scale
	Diaphragm seal material		Suitable for process fluid
	Diaphragm fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Housing		IP-55
	Zero/span adjustment		External
	Accessories		Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve
2.3	**DATASHEET - ULTRASONIC LEVEL TRANSMITTER**		
	Transmitter type		Non contact microprocessor based 2 wire type loop powered, HART protocol compatible
	Output signal	mA	4-20 mA DC (analog signal) alongwith superimposed digital signal based on HART protocol
	Accuracy	%	±0.5% of calibrated span or minimum 5mm
	Power supply	V	24V DC +/- 10%
	Temperature compensation		To be provided within transducer
	Housing material		Metallic housing with durable corrosion resistance coating
	Protection		Weather proof as per IP-65
	Sensor material		Corrosion resistant material to suit individual application requirement
	False signal tolerance		Transmitter shall be capable of ignoring false echoes from internal tank/sumped obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.
	Display		Integral digital display
	Diagnostics		Loss of echo alarm etc.
	Electrical connection		Plug and socket
	Certification		SIL2 certification required
2.4	**DATASHEET - LEVEL GAUGE**		
	Sensing element and material		Tempered toughened borosilicate gauge glass steel armoured reflex or transparent type, bicolour type
	Body material		Forged carbon steel/304 SS
	End connection		Process connection as per ASME ptc , 3/4" and drain/vent 15 NB
	Accuracy	%	± 2%
	Diaphragm seal material		Suitable for process fluid
	Diaphragm fill fluid		Inert liquid suitable for application

	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Accessories		Gasket for all KEL-F shield for transparent type vent and drain valves of steel/SS as per CS/ Alloy process requirement.
	Length of Gauge glass		Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.
2.5	**DATASHEET - TEMPERATURE TRANSMITTER**		
	Transmitter Type		Profibus PA complying to IEC 61158 with EMC compatibility as per EN 61326, Dual input
	Compatibility		fully compatible with RTDs
	Protection Class		IP-67
	Display		Integral digital display
	Diagonstic feature		Self-indicating diagnostics
	Operating ambient temperature (with display)	DegC	70 deg C
	Operating ambient temperature (without display)	DegC	85 deg C
	Electrical Connection	inch	1/2" NPT(F)
	Composite Accuracy	%	RTD ≤0.25% of 0-250 deg C span
	Changeover facility		Bump less changeover to second sensor in case first sensor fails with alarm facility.
	Composite accuracy Calculation		Accuracies of temperature transmitter for converting sensor input to output + temperature effect on these accuracies at ambient temperature of 50 deg C (based on the figure/ formula given in the standard product catalogue for span as specified for RTD).
	Emergency/failure Measures		In case of failure (open or burn-out) of RTD, transmitter shall provide low temperature output.
2.6	**DATASHEET - RESISTANCE TEMPERATURE DETECTOR (RTD)**		
	Type		Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade)
	No. of element		Duplex
	Housing		Diecast Aluminium
	Protection Class		IP-65
	Head		Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter
	Plug in connectors		Required
	Terminal head		Spring loaded for positive contacts with the thermo well
	Insulation and sheathing		Mineral (magnesium oxide) insulation and SS316 sheath
	Calibration and accuracy		As per IEC-751/ DIN-43760 Class-A for RTD
	Accessories		Thermo well and associated fittings
2.7	**DATASHEET - THERMOWELL**		
	Design		One piece solid bored type of step-less tapered design
	Material		SS316
2.8	**DATASHEET - ELECTROMAGNETIC FLOW METER**		
	Type		Flow sensor and flow indicator cum integrator / totaliser
	Measuring principle		Full bore electromagnetic principle
	Output		4-20 mA DC Isolated output
	Accuracy		± 0.5% of calibrated span or better
	Repeatability		± 0.2% of calibrated span or better
	Power Supply		240V AC ± 10%, 50 HZ ± 5%/ 24 V DC

	Protection class		IP-55
	Flow tube		SS304
	Liner		Hard Rubber
	Local indication		Required
2.9	**DATASHEET - ORIFICE PLATE**		
	Material		SS316
	Thickness		3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm.
	Tappings		Minimum 2 Pairs of Tappings, Flanged weld neck or D & D/2
	Beta Ratio		0.34 to 0.7
	Root Valves		To be provided in all the tappings
2.10	**DATASHEET - SOLENOID VALVE**		
	Type		2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.)
	Power supply		24 V DC + 10%.
	Electrical connection		Plug and socket
	Insulation		Class 'H'
	IP Class		IP65
	Limit switches (for open/close feedback)		Required
2.11	**DATASHEET - LIMIT SWITCH**		
	Type		Inductive proximity type
	Mounting arrangement		Inside the enclosure
	Operating voltage Range	V	10-40 V DC
	Sensing system		Inductive Proximity type , 2 Wire
	Sensor Contact Type		NO
	Reverse polarity and short circuit protection		Yes
	IP Class-Sensor		IP67
	IP Class-Enclosure(Switch box)		IP67
	Cable entry-Enclosure(Switch box)		2 no., 1/2" NPT
	Casing material-Sensor		Brass /SS
	Enclosure(Switch box) Housing material		FRP or SS
	Operating Ambient temp(sensors)	DegC	-5 to 70 deg C
	Max allowed Voltage Drop across sensor	V	5 V
	Applicable for		Manual valves and solenoid operated on-off valves
	Corrosion resistance		Silver plated with high conductivity and non corrosive
	Protection class		IP-55
	Contact rating		Shall be sufficient to meet the requirement of DCS subject to a minimum of 60 V, 6 VA rating
2.12	**DATASHEET - MOTORISED VALVE ACTUATOR**		
2.12.1	**General**		
	Duty		.--On / Off .--Inching
	Valve type		.--Globe .--Gate .--Reg. Globe .--Butterfly
	Ambient condition : ambient temperature		0-60 °C
	Ambient condition : relative humidity		0-95%.
2.12.2	**Construction and sizing**		
	Construction		Totally enclosed weather proof, minimum IP:68
	Mechanical position indicator		To be provided for 0-100% travel
	Bearings		Double shielded, grease lubricated anti-friction
	Gear train for limit switch/torque switch operation		Metal (not fibre gears). Self-locking to prevent drift under torque switch spring pressure when motor is de-energized.

	Sizing		Open/close at rated speed against designed differential pressure at 90% of rated voltage. For isolating service three successive open-close operations or 15 mins. Whichever is higher. **For inching service - 150 starts/hr or required cycles whichever is higher.**
2.12.3	**Handwheel**		
	Required		—Yes —No
	Orientation		—Top Mounted —Side Mounted
	Additional requirement		To disengage automatically during motor operation.
2.12.4	**Electric actuator**		
	Motor type		Squirrel cage induction motor suitable for Direct On-Line (DOL) Starting
	Power supply to motor / starter		415V +/- 10%, 3 Ph, 3W & 50Hz +/- 5%
	Control voltage requirement		To be derived from the Power Supply to the Starter 230 V / 110 V AC / 24 V DC
	Enclosure class of motor		IP 68
	Insulation class		Class F. Temperature Rise 70 °C. Over 50 °C Ambient
	Winding temp protection		Thermostat (3 Nos.,1 In Each Phase)
	Single phasing protection & wrong phase sequence protection		Required, suitable means shall be provided to diagnose the type of fault locally.
2.12.5	**Integral starter**		
	Integral starter		Required with built in SPP (Single Phasing Preventer)
	Type of switching device		—Contactors —Thyristors
	Type		Non-Intrusive Profibus Actuator
	Feature		All actuator settings including torque, limit shall be possible without opening the actuator cover.
	If smart		
	A) Serial link protocol		Profibus DP
	B) Redunadant profibus DP port		Required
	C) Hand held programmer		Not Required
	D) Profibus DP cable connection		Suitable connector integral to the actuator, or external devices/ accessories (mounted inside minimum IP65 protection class enclosure) shall be provided so that the actuator can be isolated online from the profibus network without disturbing the profibus communication of other actuators of the segment.
	E) Open/Close command termination logic		Shall be suitably built inside actuator
	F) GSD and DTM files		To be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics
	G) Available signals to DCS (through profibus network)		Open/ close commands, open/ close feedback status, disturbance signal etc. along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DCS
	Step down cont. Transformer		Required
	Open / close PB		Required
	Stop PB		Required
	Indicating lamps		Required
	Local remote s/s		Required (Lockable)
	Status contacts for monitoring		Required

2.12.6	**Position/ torque transmitter**		
	Position/torque transmitter		i. Position/limit measurement shall be done using absolute encoders which will give information of position/limit in both the directions.
			ii. Electronic measurement of torque shall be provided.
	Supply		24V DC
	Accuracy		+ 1% FS
2.12.7	**Space heater**		
	Space heater		Required
	Power supply (integral)		Power supply derived from main power supply available at actuator end
2.12.8	**Terminal block**		
	Actuator/motor terminal block		Required. For power cables, the grade of TBs shall be minimum 650V
	Terminals / connectors		Suitable terminals/ connectors, integral to actuator, for terminating profibus cables and power cables shall be provided
	Earthing terminal		Required (2nos.)
2.12.9	**Cable glands**		
	Type		Double Compression
	Material		Brass Material
	Armored fieldbus cable glands		Required
	Power cable glands		Required
2.12.10	**Wiring**		Suitable voltage grade copper wire
2.12.11	**LCD Display**		
	LCD Indication		Integral to actuator body
	Local display information		Regarding actuator alarms, status and valve position indications as a minimum.
2.12.12	**Motor considerations**		
	Power Supply		Shall operate satisfactorily under the +/- 10% supply voltage variation at rated frequency, -6% to +4% variation in frequency at rated supply voltage, simultaneous variation in voltage & frequency the sum of absolute percentage not exceeding 10%.
2.12.13	**SIL certification**		SIL2
2.12.14	**Accessories**		
	Accessories for calibration / settings / configuration of various parameters of actuator		Required
2.13	**LOCAL INSTRUMENT ENCLOSURE AND LOCAL INSTRUMENT RACK**		
	Requirement		LIE and LIR complete with all fittings, mountings & accessories, drains and utility lighting, cable & grounding cable etc.
	Construction		
	Rack	mm	1.6mm sheet plate
	Frame	mm	3mm thick channel frame of steel
	Free standing type		Yes
	Canopy		Yes, >=3mm thick steel, extended beyond the ends of the rack.
	Degree of Protection		IP-55 for LIE & JB of LIE/LIR
	Junction Box		Applicable
2.14	**JUNCTION BOX**		
	No. of ways		12/24/36/48/64/72/96/128
	Material and Thickness		4mm thick Fiberglass Reinforced Polyester(FRP)
	Type of terminal blocks		Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm2. A M6 earthing stud shall be provided.
	Protection Class		IP- 55 min. for indoor & IP-65 min for outdoor applications.
	Grounding		To be provided

	Color		RAL 7035
	Spare Terminals		At least 20% unused terminals
2.15	**DATASHEET - VARIABLE FREQUENCY DRIVE (VFD)**		
2.15.1	**OPERATING CONDITIONS**		
	Ambient Temperature		50 Deg
	Relative Humidity		95% at 40DegC
	Rated frequency		50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.
	Voltage level for the VFD output to be fed to motor (Upto 400 kW)		415V/690V, Low Voltage, Three Phase AC (LV VFD)
2.15.2	**SYSTEM DESCRIPTION**		
	Type of drive		3-Phase Diode / Thyristor / Multi Stage IGBT / IGCT / SGCT/ IEGT
	Type of Cooling of VFD		Naturally air cooled/forced air cooled/Liquid cooled
	Converter Type		Full wave diode rectifier/active front end type
	Inverter Type		Thyristor/IGBT/IGCT/SGCT/IEGT
2.15.3	**GENERAL REQUIREMENTS**		
	Design		Modern proven design in power plant/industry
	415 V/690 V LV VFD		Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum Twelve (12) pulse design / 6 pulse with active front end harmonic filter.
			For drives less than 100 KW Six (6) pulse
	Impact of VFD operation on Motors/ cables & supply system		no inherent detrimental impact
	Multiple VFDs for particular application		shall be of same design so as to ensure 100 % interchangeability of components
2.15.4	**TECHNICAL AND OPERATIONAL REQUIREMENTS**		
	System Design		Shall be designed to deliver the motor input current and torque for the complete speed torque characteristics of the driven equipment, with worst input supply voltage and frequency variation.
			Shall be suitable for the load characteristics and the operational duty of the driven equipment
	Overload capacity of the controller :		
	- for constant torque applications		150% of the rated current for one minute
	- for variable torque applications at rated voltage		110% of rated current for one minute
	- If the motor load exceeds the limit		Automatically reduction of the frequency and voltage to the motor to guard against overload.
	Operating modes		Variable torque changing as a function of speed / Constant torque over a specific speed range / Constant power over a specific speed range / Any other
	Total harmonic voltage and current distortion limits		Shall comply to IEEE 519 & IEC 61000
	Withstanding power		Capable of thermal, dynamic stresses and transient mechanical torque, resulting from short circuit
	Damage control		Any damage resulting from short circuit or internal fault shall be limited to the component concerned.
	Easy access to hardware		To be provided
	Provision for replacement of card (in case of failure)		To be provided
	Allowable speed variation		Within range 10-110% or as per the requirement of driven equipment with speed set accuracy of +1% of rated maximum speed and steady state regulation of +0.5% of rated speed as per system requirement
	Power Factor for LV VFD		0.95 (minimum)

	Maximum allowable audible noise		85 dB (A) at a distance of one meter under rated loaded with all cooling fan operating conditions.
	Circuit components protection		Suitably protected against over voltages, surges, lightning etc.
	Programmed warning and fault protection function		Display a message in complete English words or Standard English abbreviations
	Drive's fault history		At least 30 time tagged fault messages to be stored
	AC environment for VFDs (>=100KW)		Required
	AC environment for VFDs (<100KW)		Not required
	Fiber optic cable connection		To be provided preferably to ensure high network reliability
2.15.5	**VFD COMPATIBILITY WITH THE MOTOR**		
	Inherent output harmonic resonance		Shall not be present in operating speed range
	Limitations of the motor cable length		VFD shall provide stable operation of motor from high-voltage dv/dt stress, regardless of cable length to motor, in case of any limitation , the vendor shall clearly state the limitations in the motor cable distance in his proposal
	If cable length becomes critical due to system requirements & constraints		filters/ chokes etc. shall be provided by the VFD manufacturers as an integral part of the VFD to mitigate the reflected wave effect of harmonics.
2.15.6	**BYPASS ARRANGEMENT (Optional)**		
	Bypass mode		Operation of Motor with VFD bypassed
	Bypass mode operation		During starting (under rated conditions) the motor will be switched on in VFD Mode to limit the starting current and after gaining speed, the load would be switched over to bypass mode.
	Comprehensive motor protection scheme for protection and control		Shall be decided during detailed engineering
2.15.7	**STANDBY VFD ARRANGEMENT (Optional)**		
	Common standby arrangement with auto/manual switchover		Required
	Changeover module		Complete protection, interlocks & control required
2.15.8	**EFFICIENCY**		
	Efficiency		Minimum 98%
	Efficiency evaluation parameters		Input transformer, harmonic filters and power factor correction (if applicable), VFD converters, cooling fans and output filter, as applicable in the system. Auxiliary controls : VFD control boards, cooling fans/pumps
	Valid test report		Required
2.15.9	**COOLING SYSTEM**		
	Type		Air cooled Design
	Air-flow pressure switches		Required for monitoring purpose
	Temperature detectors		Required for monitoring purpose
	Cooling fans		Integral to the VFD/ enclosure, If the fan fails, the system must generate the alarm/trip for the fan failure
2.15.10	**MOTOR**		
	Type		Three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application
	Bearings		Insulated bearing on at least one side for motor frame size above 250 frame
	Power Supply Requirement		Solid state power supply consisting of an adjustable frequency inverter for speed control Motor shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.
	Motor Insulation design		To accept the applied voltage waveform, within the Vpeak and dv/dt limits as per IEC-61800

2.15.11	**OUTPUT FILTER (AS APPLICABLE):**		
	Output/ dv/dt filter		Required for protection of motor from high voltage dv/dt stress.
			Shall be included within the VFD enclosure
2.15.12	**DC LINK CAPACITOR (AS APPLICABLE):**		
	Type		Self-healing film or electrolytic type having high life time
	Discharge resistors		Required, shall be capable of reducing the residual charges to zero just after the capacitor is disconnected from the supply source.
	Suitable for high ripple currents		Yes
2.15.13	**AC/DC Reactor (As applicable)**		
	Type		Dry type, air cored, self cooled, indoor type. Suitable for withstanding earth fault continuously
	Insulation		Thermal Class 155(F), temperature rise is limited to thermal class 130 (B)
	Noise level		Shall not exceed value specified in NEMA TR-1
2.15.14	**VFD PANEL REQUIREMENTS**		
	Enclosure frames		Required
	Load bearing members		Required
	Cable entry		Bottom of the panel with a removable bolted un-drilled gland plate.
	Protection (as per IS/IEC 60947)		IP: 4X or better for LV VFD
	Enclosure Design Criteria		Shall avoid harmonic and inductive heating effects and to shield any outside equipment from interference, to eliminate any radio frequency interference
	Protection against electromagnetic emissions		To be provided
	Illuminating lamp		Required
	Space heater with switch fuse		Required
	Variable setting thermostat.		Required
	Ventilation using air filters and fans/pumps		Required, to ensure that maximum temperature inside the cubicle is within permissible limits for reliable and continuous operation of the system.
	Terminal block		Separate Terminal block for power and control cable
2.15.15	**LT & HT CABLES**		Required, suitable for VFD system
2.15.16	**CONTROL AND PERFORMANCE REQUIREMENTS**		
	Automatic current limiting feature		Required, to control motor currents during startup and provide a “soft start” torque profile for the motor load combination
	Current and torque limit adjustments		Required
	Drive Speed control		Local or Remote mode
	Local / Remote selection provision		from VFD panel
	Parameter Monitoring		- Input and output voltage of Drive - Input and output current of Drive - Motor speed - Input and output power frequency of Drive -Torque - Output kWhr of Drive - Ambient temperature - Run/stop and local/remote status displayed

	Operator console panel features		Front mounted
			Backlit alphanumeric display
			A keypad with keys for parameterization and adjusting parameter
			Facility / port to connect external hardware
			Upload and download of all parameter settings from one drive to another drive for start up and operation
			User-friendly licensed software for operation and fault diagnostic
	Protection features		i) Converter transformer: short circuit, over current, earth fault & winding temperature high protection.
			ii) Incoming and outgoing line surge protection.
			iii) Under / over voltage protection
			iv) Phase loss, phase reversal, overload, negative phase sequence, locked rotor protection.
			v) Instantaneous Over current & Earth fault protection
			vi) Converter/Inverter module failure indication.
			vii) Over frequency/speed protection.
			viii) Ventilation failure indication & alarm.
			ix) Over temperature of VFD
			x) Bearing temperature protection.
			xi) System earth fault protection.
			xii) Speed reference loss protection.
	Operator Control PaneL (on the front panel door)		Start / stop (in local/remote mode)
			Speed control (Raise / lower)
			Acknowledge/Accept/ Test Push Button for annunciation
			Auto / Manual / Test Mode select
			Emergency stop
			Trip-Remote Breaker
2.15.17	**DIAGNOSTIC FEATURES**		Microprocessor/PLC based digital diagnostic system which monitors its own control functions and displays faults and operating conditions
			Information regarding failure of any of the system including shut down of the system shall be available.
			It shall be possible to retrieve the record of events prior to tripping of the system or de-energization.
			Auxiliary supply to the system components or to the electronics (firmware) for the diagnostics / display shall be taken care of by the manufacturer for this purpose.
2.15.18	**SERVICEABILITY / MAINTAINABILITY**		
	Power Component Accessibility		All power components in the converter sections shall be designed for rack-out accessibility for ease of maintenance and to minimize repair downtime
	Marking / Labelling		Sleeve type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual labels shall be provided for all major components of the VFD system
2.16	**DATASHEET - MODULATING DUTY ELECTRIC ACTUATOR**		
	Duty		Continuous duty / Modulation
	Operating Ambient Temperature		-20 to +60 Deg C or better
	Enclosure Protection		IP 68
	Resolution/ Precision		0.1%- 0.2% or better of total travel
	Supply Voltage frequency		415V +/- 10%, 3 Phase, 50HZ +/-5% or 230V +/- 10%, Single Phase, 50Hz +/- 5%
	Motor Suitable for		Continuous Duty
	Motor insulation Class		F

	Analog Control		4-20mA (24VDC)
	Position Transmitter		4-20mA (24VDC)
	Integral Starter		Yes
	Terminal Block		For power cables, the grade of TBs shall be minimum 600V
	Accessories (if applicable)		For calibration / settings/ configuration of various parameters of actuator shall be provided
	Hand wheel		Yes
2.17	**COMMON REQUIREMENTS FOR PROCESS ACTUATED SWITCH**		
	Repeatability		+/-0.5% of full range
	No. of contacts		2 No.+2NC. SPDT snap action dry contact
	Rating of contacts		60 V DC, 6 VA
	Elect. Connection		Plug in socket.
	Set point adjustment		Provided over full range.
	Dead band adjustment		Adjustable/ fixed as per requirement of application.
	Enclosure		IP-55
	Power Supply		24V DC
2.18	**Impulse piping for water area/equipment**		
	Painting color scheme		Grey RAL 9002
	Identification Tag/band color scheme		Sea green, ISC no. 217
2.18	**Impulse piping for water area/equipment**		
	Painting color scheme		Grey RAL 9002
	Identification Tag/band color scheme		Sea green, ISC no. 217
3.0	**INSPECTION/TESTING**		
3.1	Type Test requirement		Yes
	Item-1		Electronic Transmitters
	Test & Standard -1		As per Standard, BS-6447 / IEC-60770
	Item-2		Orifice Plate
	Test & Standard -2		Calibration, ISO 5167
	Test to be specifically conducted		No
	NTPC's approval required. on Test certificate		Yes

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT) - MECHANICAL			
SL.NO	**DESCRIPTION**	**UOM**	**DETAIL**
1.0	**CONSTRUCTION FEATURES**	--	--

S.No.	Description	Data	
1	**General**		
a.	Client	BHEL-PEM, Noida	
b.	Project	NTPC LARA SUPER THERMAL POWER PROJECT STAGE-II (2 X 800 MW)	
c.	End customer	NTPC Limited	
d.	Location	Raigarh town near village Lara, - INDIA.	
e.	Service	Continuous	
f.	Installation	Inside the Building	
g.	Quantity for 2 FGD units	2 sets (1W+1S)	
2	**Manufacturer details**		
a.	Model		
b.	Type		
3	**Operating conditions**		
a.	Medium to be handled	Gypsum slurry	
4	**Technical data**		
4.1	Primary And Secondary Hydro-Cyclone		
		Primary Hydro-Cyclone	Secondary Hydro-Cyclone
i	Stage		
ii	Manufacturer		
iii	Number Of Hydro Cyclone		
iv	Diameter Of Hydro Cyclone		
v	Diameter Of Vortex Finder		
vi	Diameter Of Apex Valve		
vii	Diameter Of Feed Inlet		
viii	Design Pressure		
ix	Working Pressure		
x	Feed Flow Rate		
xi	Overflow Rate		
xii	Underflow Rate		
xiii	Mesh Of Separation (50% Removed)		
xiv	Solid Content Of Feed Slurry		
xv	Solid Content In Underflow Of Hydrocyclone		
xvi	Solid Content In Overflow Of Hydro-cyclone		
xvii	**Type Of Cyclone**		
(A)	Cyclone Dia / Height (mm)		

(B)	Required Liquid Feed Pressure		
(C)	Cyclone Connection Number/Dia. (mm)		
(D)	Feed		
(E)	Overflow		
(F)	Underflow		
(G)	Rf Value (Underflow Slurry -m3/hr/Feed Slurry-m3/hr)		
(H)	Material		
(I)	Shell		
(J)	Internal Structure Part		
(K)	Lining		
(L)	Particle Size Distribution		
(M)	Weight		
5	**Vacuum Belt Filters (VBF)**		
a.	Manufacturer		
b.	Model No.		
c.	Dimensions (W x L x H) (m x m x m)		
d.	Cloth Width (m)		
e.	Cloth Length (m)		
f.	No. Working / Stand-by		
g.	Capacity (Guaranteed)		
	Gypsum (Dry) Kg / Hr		
	Gypsum (Slurry) M3/Kg		
h	Inlet Flow		
	Volume m3/h		
	Solid Concentration %w/w		
i	Gypsum Flow (Dry) Kg/hr		
j	Moisture Removed %		
k	No. of stages of cake washing / water flow (m3/hr)		
l	No. of stages of cloth washing / water flow (m3/hr)		
m	Design Pressure of Vacuum Chamber		
n	Operating Pressure of Vacuum Chamber		
o	**Material / Thickness mm**		
i.	Casing		
ii.	Cloth		
iii	Gypsum Discharge Hopper		
iv	Vacuum Box		
p	Life of Cloth hrs		
q	Type /Material of Carrying Belt		
r	Type / Material of Sealing Belt		
s	Life of Carrying Belt hrs		
t	Life of Sealing Belt hrs		

u	Automatic Cloth Tensioning Mechanism Provided		
6	**Vacuum Receiver Tank**		
a.	No. of Tank for each VBF		
b.	Capacity (m3)		
c.	Dimensions (Dia x Height) (mm x mm)		
d.	Material / Thickness (mm)		
e.	Lining Material / Thickness mm		
7	**Vacuum Pumps**		
a.	Manufacturer		
b.	Make/Model		
c.	Type		
d.	No. of Pumps for each Vacuum Belt Filter		
E	Rated Capacity Flow (m^3/hr)		
	Rated Capacity Head (mWCI)		
	Rated Capacity Power (KW)		
G	Power consumption (KW)		
H	Pump Speed (rpm)		
I	Motor Rating (KW)		
J	Motor Speed (rpm)		
K	Margins (Flow/Head) (%/%)		
L	Operation Pressure		
M	Design Pressure		
N	Material/Thickness (mm) of		
	Base/Lining		
	Casing		
	Shaft		
	Impeller		
O	Type of seal		
P	Sealing Water Flow (m3/hr)		
Q	Bearing		
	No. of Bearings		
	Type Of Bearings		
R	Type of coupling		
S	Whether silencer provided at outlet		
8	**Slurry Pipes**		
a.	Pipe size (mm)		
b.	Type of Joints		
	Pipe to Pipe/Pipe to Fittings		
	Fittings		
c	Material / Thickness (mm)of Pipe		
d	Material Thickness of lining		
e	Estimated Life of liners (hrs.)		
f	Slurry Solid concentration (w/w%)		

g	Slurry Settling Velocity (m/s)		
h	Pipe Velocity (m/s)		
9	**Belt Filter Wash Pumps**		
a.	No. for each VBF		
b	No. of stand-by pumps for each VBF		
c	Make / Model		
d	Impeller Type		
e	Material / Thickness (mm) of Impeller and lining		
f	Casing Type		
g	Material/Thickness of Casing/Lining		
h	Rated Flow/Head (m3/hr./mWCI)		
10	**Cake Wash Pumps**		
a.	No. for each VBF		
b	No. of stand-by pumps for each VBF		
c	Make / Model		
d	Impeller Type		
e	Material / Thickness (mm) of Impeller and lining		
f	Casing Type		
g	Material/Thickness of Casing/Lining		
h	Rated Flow/Head (m3/hr./mWCI)		
11	**Belt Accessories**		
11.1	**Bearing**		
a.	Carrying		
b.	Return		
11.2	**Material**		
a.	Roller		
b.	Spindle		
11.3	**Pulleys**		
(I)	General (For All Types Of Pulleys)		
a	Pulley Shaft Diameter		
(II)	Drive Pulleys		
A	Lagging		
B	Lagging thickness		
C	Minimum angle of wrap		
D	Maximum out of roundness		
(III)	Other Pulleys		
A	Lagging		
B	Lagging Thickness		
(IV)	Rubber For Lagging		
A	Type		
B	Hardness		
C	Elongation		

D	Strength		
E	Abrasion Loss		
F	Specific Gravity		
G	Adhesion Strength		
(V)	**Bearings for Pulleys**		
A	Type		
B	Casing		
C	Sealing		
D	Lubrication		
E	Pulley Material		
F	Shaft Material		
12	**Chutes And Hoppers**		
a.	Minimum Valley Angle		
b.	Material		
(i)	Chute work		
(ii)	Sliding zones & adjacent sides		
(iii)	No striking/ Non sliding zones		
(iv)	Chute with valley angle 80 degree and above		
(v)	In the zone of magnetic field		
(vi)	In the zone of flap gates		
(vii)	Discharge Hoods overhead pulleys		
c.	Inspection Doors		
D	Chute Construction		
(I)	Corners		
(II)	Joints Bolted		
(iii)	Bolt size		
(iv)	Bolts spacing		
(v)	Fixing Arrangement		
12.1	**Skirt Boards**		
a	Length		
b	Height		
c	Width		
	Side plate		
	Top cover		

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT) - ELECTRICAL			
SL.NO	**DESCRIPTION**	**UOM**	**DETAIL**
1.0	**GENERAL**		
i)	Manufacturer & Country of origin.		
ii)	Equipment (driven by motor)		
iii)	Motor type		

iv)	Country of origin		
v)	Quantity	nos.	
2.0	**DESIGN AND PERFORMANCE DATA**		
i)	Frame size		
ii)	Type of duty		
iii)	Type of enclosure and method of cooling		
vi)	Type of mounting		
vii)	Direction of rotation as viewed from DE END		
viii)	Standard continuous rating at 40 deg.C. ambient	(KW)	
ix)	Derated rating for specified normal condition i.e.	(KW)	
x)	Rating as specified in load list	(KW)	
xi)	Rated speed at rated voltage and frequency	rpm	
xii)	At rated Voltage and frequency		
a)	Full load current	A	
b)	No load current	A	
xiii)	Power Factor at		
a)	100% load		
b)	At duty point		
c)	75% load		
d)	50% load		
e)	NO load		
f)	Starting.		
xiv)	Efficiency at rated voltage and frequrecy		
a)	100% load		
b)	At duty point		
c)	75% load		
d)	50% load		
xv)	Starting current*(inclusive of IS tolerance)* at		
a)	100 % voltage	A	
b)	Minimum starting voltage	A	
xvi)	Starting time with minimum permissible voltage		
a)	Without driven equipment coupled	sec	
b)	With driven equipment coupled	sec	
xvii)	Safe stall time with 110% of rated voltage		
a)	From hot condition	sec	
b)	From cold condition	sec	
xviii)	**Torques :**		
a)	Starting torque at min. permissible voltage	(kg-mtr.)	
b)	Pull up torque at rated voltage.	(kg-mtr.)	
c)	Pull out torque	(kg-mtr.)	
d)	Min accelerating torque available	(kg-mtr.)	
e)	Rated torque	(kg-mtr.)	
xix)	Stator winding resistance per phase (at 20 ºC)	Ohm	

xx)	GD^2 value of motors		
xxi)	Locked rotor KVA input (at rated voltage)		
xxii)	Locked rotor KVA/KW.		
xxiii)	**Bearings**		
a)	Type		
b)	Manufacturer		
c)	Self Lubricated or forced Lubricated		
d)	Recommended Lubricants		
e)	Guaranteed Life in Hours		
f)	Whether Dial Type thermometer provided		
g)	Oil pressure Gauge/switch		
	i. Range		
	ii. Contact Nos. & ratings		
	iii. Accuracy		
xxiv)	**Vibration**		
a)	Velocity	mm/s	
b)	Displacement	microns	
xxv)	Noise level	db	
3	**CONSTRUCTIONAL FEATURES**		
i	Stator winding insulation		
a)	Class & Type		
b)	Tropicalised (Yes/No)		
c)	Temperature rise over specified max.		
	i. Cold water temperature of 38 DEG. C.		
	ii. Ambient Air 50 DEG. C.		
d)	Method of temperature measurement		
e)	Stator winding connection		
f)	Number of terminals brought out		
ii	Type of terminal box for		
a)	Stator leads		
b)	Space heater		
c)	Temperature detectors		
d)	Instrument switch etc.		
iii)	For main terminal box		
a)	Location		
b)	Entry of cables		
c)	Recommended cable size		
d)	Fault level	MVA	
iv)	Temperature detector for stator winding		
a)	Type		
b)	Nos. provided		
c)	Location		

d)	Make		
e)	Resistance value at 0 deg. C	ohms	
vi)	Paint shade		
vii).	Weight of(approx)		
a)	Motor stator (KG)		
b)	Motor Rotor (KG)		
c)	Total weight (KG)		
4	Relevant motor curves		

COMPLIANCE DRAWINGS

Sl. No.	Drawing/Document Title	Drawing No.
1	PROCESS PARAMETERS FOR SIZING OF GDWE	GDWE-508-571-DATA (SHEET 1 & 2 OF 6)
2	WATER ANALYSIS	GDWE-508-571-DATA (SHEET 3 OF 6)
3	PARTICLE SIZE DISTRIBUTION	GDWE-508-571-DATA (SHEET 4 OF 6)
4	SCHEDULE OF GUARANTEES	GDWE-508-571-DATA (SHEET 5-6 OF 6)
5	P&ID - Legends & Notes	GDWE-508-571-PID (SHEET 1 & 2 OF 2)
6	P&ID - Primary Hydrocyclone Feed Tank	9587-001-109-PVM-F-020 (SHEET 1 OF 12)
7	P&ID - Primary Hydrocyclone	9587-001-109-PVM-F-020 (SHEET 2 OF 12)
8	P&ID of Gypsum Belt filter / Vacuum Belt filter - A & B	9587-001-109-PVM-F-020 (SHEET 3 & 4 OF 12)
9	P&ID Belt Filter Wash Tank - A & B	9587-001-109-PVM-F-020 (SHEET 5 & 6 OF 12)
10	P&ID Clarified Water Tank - A & B	9587-001-109-PVM-F-020 (SHEET 7 & 8 OF 12)
11	P&ID -Filtrate Water Tank	9587-001-109-PVM-F-020 (SHEET 9 OF 12)
12	P&ID - Secondary Hydrocyclone Feed Tank along	9587-001-109-PVM-F-020 (SHEET 10 OF 12)
13	P&ID - Secondary Hydrocyclone	9587-001-109-PVM-F-020 (SHEET 11 OF 12)
14	P&ID -Waste Water Tank	9587-001-109-PVM-F-020 (SHEET 12 OF 12)
15	GYPSUM DE-WATERING BUILDING DRAWING	9587-001-109-PVM-F-020 (SHEET 1 & 2 OF 2)

1.0 GYPSUM DEWATERING SYSTEM SELECTION DATA

1.1 Process Parameters For Primary Hydro cyclone

Sl. No.	Parameters	Unit	Primary Hydro Cyclone Feed Slurry	Primary Hydro Cyclone Over Flow	Primary Hydro Cyclone Under Flow
a.	Total Flow	$m^3/hr.$	152.48	88.06*	64.42*
b.	Total Flow	t/hr.	185.59	98.02*	87.57*
c.	Operating Temp	°C	59.5	59.5	59.5
d.	Design Temp	°C	70	70	70
e.	Solid (wt. %)	%	30	16.6*	**45#**
f.	Density	Kg/m^3	1217	1113*	1359*
g.	pH		4-7	4-7	4-7
h.	Chloride Cl^-	mg/l	25000	25000	25000
i.	Number of Prim hydro cyclones : 2 numbers (1 W + 1 S)				
j.	Back pressure of Primary hydro cyclones inlet shall be maintained **<20 m L.C**				
k.	Each Primary hydro cyclone to be sized for : **167.8 m^3/hr.** (including 10 % margin)				
l.	Each set of primary hydro cyclone shall be provided with 10% spare hydro-cyclones as per contract specification.				

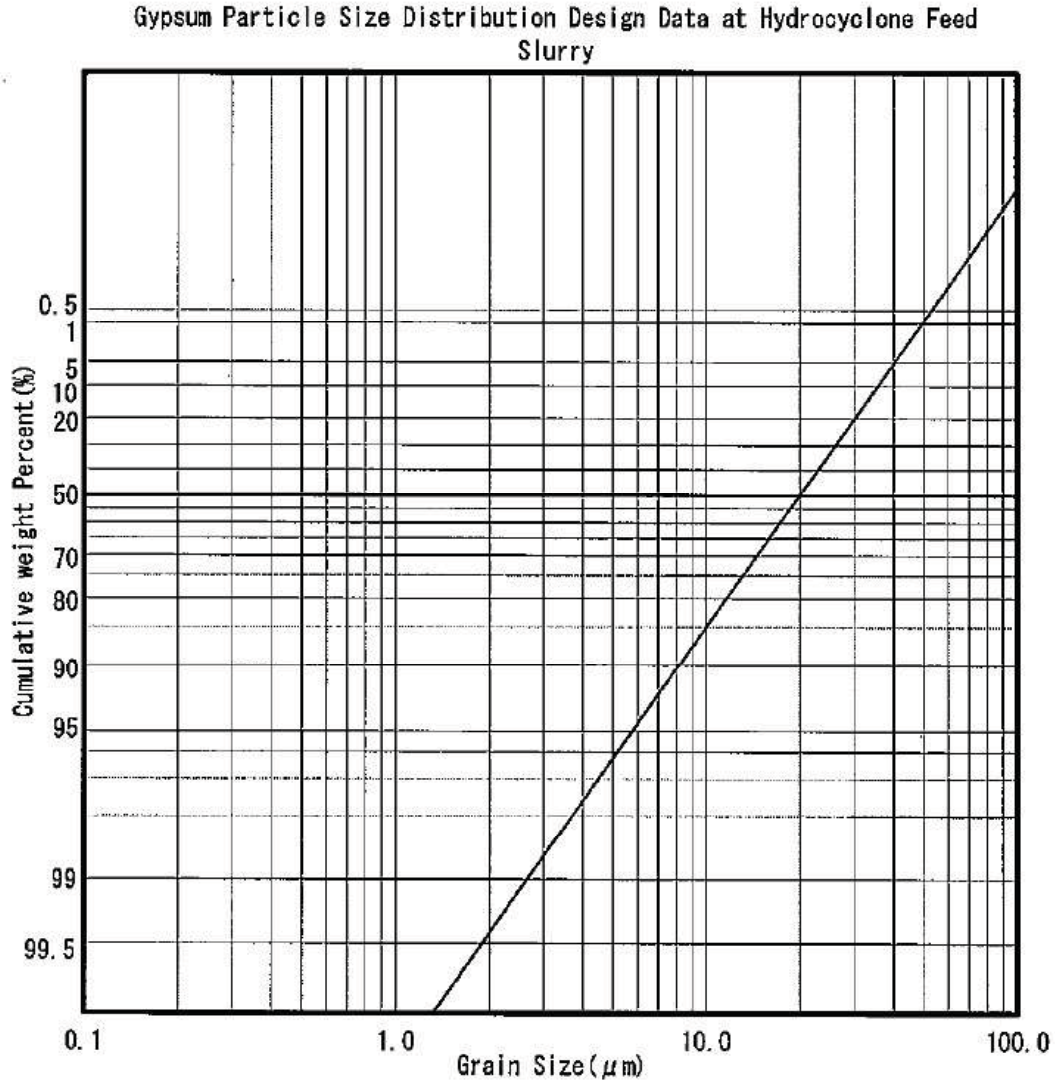
1.2 Process Parameters For Secondary Hydro cyclone

Sl. No.	Parameters	Unit	Secondary Hydro cyclone Feed Slurry	Secondary Hydro cyclone Overflow	Secondary Hydro cyclone Under flow
a.	Total flow	$m^3/hr.$	88.06	55.02*	33.04*
b.	Total flow	t/hr.	98.02	56.36*	41.66*
c.	Operating Temp	°C	59.5	59.5	59.5
d.	Design Temp	°C	70	70	70
e.	Solid (wt. %)	%	16.6	**3#**	35*
f.	Density	Kg/m^3	1113	1024	1261
g.	pH		4-7	4-7	4-7
h.	Chloride Cl^-	mg/l	25000	25000	25000
i.	Number of Sec hydro cyclones : 2 numbers (1 W + 1 S)				
j.	Back pressure of Secondary hydro cyclones inlet shall be maintained **<20 m L.C.**				
k.	Sec Hydro cyclone shall be located in Vacuum Belt filter floor level.				
l.	Each Secondary hydro cyclone to be sized for : **88.1 m^3/hr.**				
m.	Each set of Secondary hydro cyclone shall be provided with 10% spare hydro-cyclones as per contract specification.				

2.0 PROCESS WATER ANALYSIS FOR BELT & CLOTH WASHING

2X800 MW LARA STAGE II PROPOSAL (TENTATIVE)			
SL. NO.	**Parameters**	**UNIT**	**EXPECTED & TENTATIVE CIRCULATING/ BLOWDOWN WATER ANALYSIS (COC = 5)**
1	pH		7.6-8.5
2	Turbidity	NTU	50
3	P-Alkalinity	mg/l as $CaCO_3$	--
4	M-Alkalinity	mg/l as $CaCO_3$	775.9
5	Total Hardness	mg/l as $CaCO_3$	1282.5
6	Calcium	mg/l as $CaCO_3$	862.5
7	Magnesium	mg/l as $CaCO_3$	420
8	Chloride	mg/l as Cl	214.1
9	Sulphate	mg/l as SO_4	577.5
10	Total Silica	mg/l as SiO_2	125
11	Colloidal Silica	mg/l as SiO_2	25
12	Reactive Silica	mg/l as SiO_2	100
13	Sodium + Potassium	mg/l as Na	125
14	Total Organic Carbon (TOC)	mg/l	25
15	Chemical Oxygen Demand (COD)	mg/l	75
16	Biological Oxygen Demand (BOD)	mg/l	5
17	Equivalent Mineral Acid (EMA)	mg/l	791.6
18	Total Suspended Solids (TSS)	mg/l	--
19	Total Iron	mg/l as Fe	1.5
20	$KMnO_4$ No.	mg/l	BDL
21	Dissolved Oxygen (DO)	mg/l	35 TO 40
22	Temperature	Deg C	28-36
23	TDS	ppm	2380
24	Total cations	mg/l as $CaCO_3$	1565
25	Total anions	mg/l as $CaCO_3$	1565

3.0 PARTICLE SIZE DISTRIBUTION



Note:

1. This Curve is applicable at primary hydro cyclone feed only.
2. Vendor to submit the PSD based on their design for PHC & SHC underflow and overflow.

4.0 WATER PIT PUMPS:

Vacuum Pump is generally kept in the elevated floor from ground level, because the sealing water from vacuum pump flow by gravity to the belt filter washing tank. If vacuum pump is kept in this ground floor, a pit of size 2m(L)X 2m(W) X 2m(H) and additional water pit pumps 2 No's (1W+1S) shall be provided by PEM.

5.0 SCHEDULE OF GUARANTEES

Sl. No	Description	Unit	Data
1.	Rated capacity of Vacuum Belt Filter (VBF)	TPH	47.9 (Wet)
2.	Power consumption at rated capacity	kW	Bidder to Provide
3.	Chloride content in output gypsum cake	ppm	<100
4.	Moisture in output gypsum cake	%	≤10

6.0 GENERAL NOTES

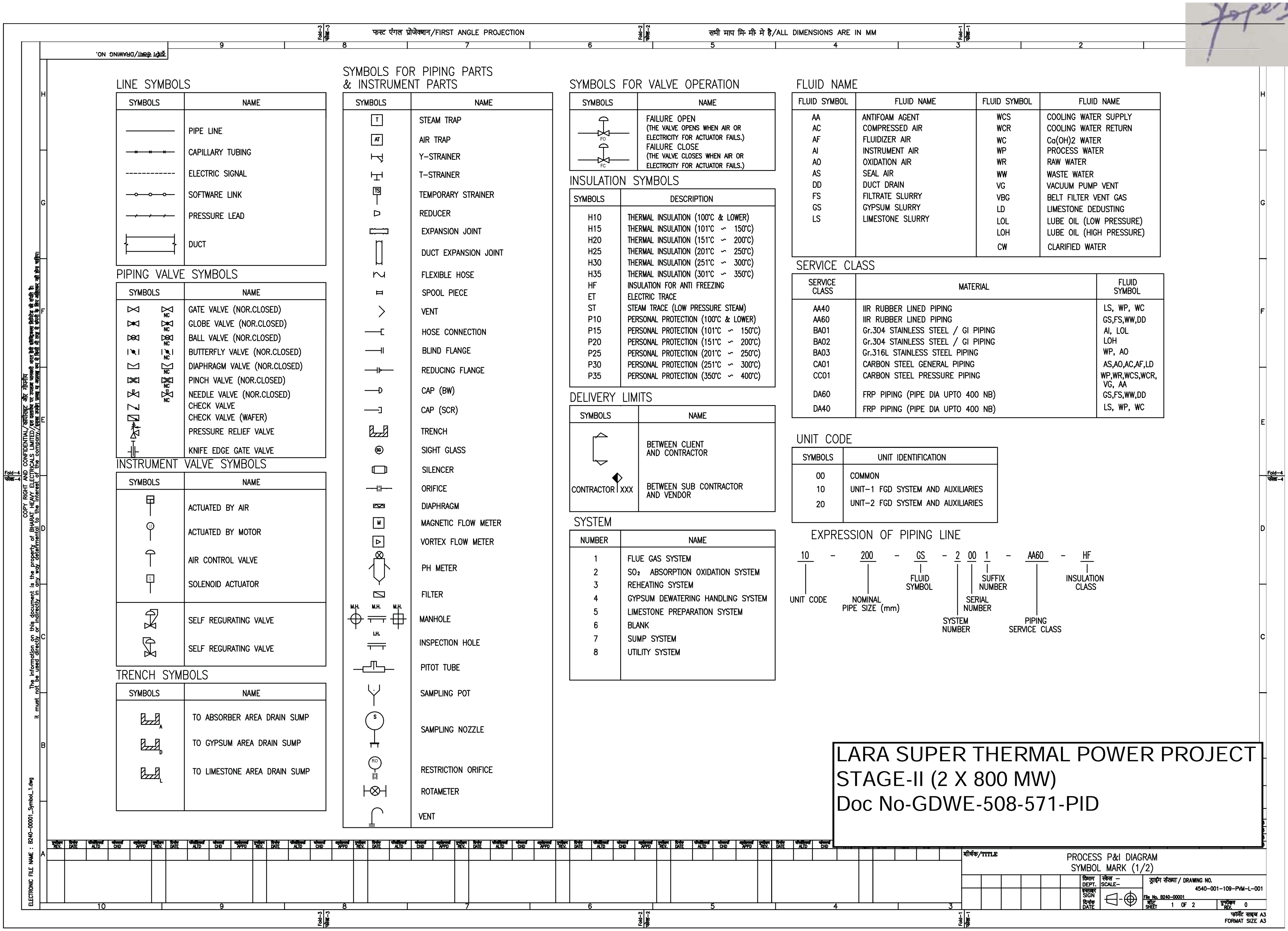
a) Power consumption to be guaranteed as per contract guarantee conditions. Maximum aux power (for vacuum belt filter, vent fan, vacuum pump, agitators in primary hydro cyclone feed tank, secondary hydro cyclone feed tank, filtrate water tank, waste water tank, cake wash pump, belt filter wash pump) corresponding to rated capacity of **47.9 TPH(wet)** shall not exceed value quoted during **proposal stage**.

b) Gypsum dewatering system including all associated equipment are under **PEM scope of supply** except primary hydrocodone feed pumps, secondary hydro cyclone feed pumps, waste water pumps and filtrate water pumps which are in BAP's scope of supply.

c) Refer NTPC contract specification for MOC and other technical requirements of Gypsum dewatering system and its accessories

d) PID will be submitted later after obtaining approval from customer. Instruments and valves to be provided as per the approved PID

e) Mandatory spares to be supplied as per contract requirement.



LINE SYMBOLS

SYMBOLS	NAME
	PIPE LINE
	CAPILLARY TUBING
	ELECTRIC SIGNAL
	SOFTWARE LINK
	PRESSURE LEAD
	DUCT

PIPING VALVE SYMBOLS

SYMBOLS		NAME
	NC	GATE VALVE (NOR.CLOSED)
	NC	GLOBE VALVE (NOR.CLOSED)
	NC	BALL VALVE (NOR.CLOSED)
	NC	BUTTERFLY VALVE (NOR.CLOSED)
	NC	DIAPHRAGM VALVE (NOR.CLOSED)
	NC	PINCH VALVE (NOR.CLOSED)
	NC	NEEDLE VALVE (NOR.CLOSED)
		CHECK VALVE
		CHECK VALVE (WAFER)
		PRESSURE RELIEF VALVE
		KNIFE EDGE GATE VALVE

INSTRUMENT VALVE SYMBOLS

SYMBOLS	NAME
	ACTUATED BY AIR
	ACTUATED BY MOTOR
	AIR CONTROL VALVE
S	SOLENOID ACTUATOR
	SELF REGURATING VALVE
	SELF REGURATING VALVE

TRENCH SYMBOLS

SYMBOLS	NAME
A	TO ABSORBER AREA DRAIN SUMP
D	TO GYPSUM AREA DRAIN SUMP
L	TO LIMESTONE AREA DRAIN SUMP

SYMBOLS FOR PIPING PARTS & INSTRUMENT PARTS

SYMBOLS	NAME
T	STEAM TRAP
AT	AIR TRAP
	Y-STRAINER
	T-STRAINER
TS	TEMPORARY STRAINER
	REDUCER
	EXPANSION JOINT
	DUCT EXPANSION JOINT
	FLEXIBLE HOSE
	SPOOL PIECE
	VENT
	HOSE CONNECTION
	BLIND FLANGE
	REDUCING FLANGE
	CAP (BW)
	CAP (SCR)
	TRENCH
SG	SIGHT GLASS
	SILENCER
	ORIFICE
	DIAPHRAGM
M	MAGNETIC FLOW METER
	VORTEX FLOW METER
	PH METER
	FILTER
M.H. M.H. M.H.	MANHOLE
I.H.	INSPECTION HOLE
	PITOT TUBE
	SAMPLING POT
S	SAMPLING NOZZLE
RO	RESTRICTION ORIFICE
	ROTAMETER
	VENT

SYMBOLS FOR VALVE OPERATION

SYMBOLS	NAME
FO	FAILURE OPEN (THE VALVE OPENS WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)
FC	FAILURE CLOSE (THE VALVE CLOSES WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)

INSULATION SYMBOLS

SYMBOLS	DESCRIPTION
H10	THERMAL INSULATION (100℃ & LOWER)
H15	THERMAL INSULATION (101℃ ~ 150℃)
H20	THERMAL INSULATION (151℃ ~ 200℃)
H25	THERMAL INSULATION (201℃ ~ 250℃)
H30	THERMAL INSULATION (251℃ ~ 300℃)
H35	THERMAL INSULATION (301℃ ~ 350℃)
HF	INSULATION FOR ANTI FREEZING
ET	ELECTRIC TRACE
ST	STEAM TRACE (LOW PRESSURE STEAM)
P10	PERSONAL PROTECTION (100℃ & LOWER)
P15	PERSONAL PROTECTION (101℃ ~ 150℃)
P20	PERSONAL PROTECTION (151℃ ~ 200℃)
P25	PERSONAL PROTECTION (201℃ ~ 250℃)
P30	PERSONAL PROTECTION (251℃ ~ 300℃)
P35	PERSONAL PROTECTION (350℃ ~ 400℃)

DELIVERY LIMITS

SYMBOLS	NAME
	BETWEEN CLIENT AND CONTRACTOR
CONTRACTOR XXX	BETWEEN SUB CONTRACTOR AND VENDOR

SYSTEM

NUMBER	NAME
1	FLUE GAS SYSTEM
2	SO₂ ABSORPTION OXIDATION SYSTEM
3	REHEATING SYSTEM
4	GYPSUM DEWATERING HANDLING SYSTEM
5	LIMESTONE PREPARATION SYSTEM
6	BLANK
7	SUMP SYSTEM
8	UTILITY SYSTEM

FLUID NAME

FLUID SYMBOL	FLUID NAME	FLUID SYMBOL	FLUID NAME
AA	ANTIFOAM AGENT	WCS	COOLING WATER SUPPLY
AC	COMPRESSED AIR	WCR	COOLING WATER RETURN
AF	FLUIDIZER AIR	WC	Ca(OH)2 WATER
AI	INSTRUMENT AIR	WP	PROCESS WATER
AO	OXIDATION AIR	WR	RAW WATER
AS	SEAL AIR	WW	WASTE WATER
DD	DUCT DRAIN	VG	VACUUM PUMP VENT
FS	FILTRATE SLURRY	VBG	BELT FILTER VENT GAS
GS	GYPSUM SLURRY	LD	LIMESTONE DEDUSTING
LS	LIMESTONE SLURRY	LOL	LUBE OIL (LOW PRESSURE)
		LOH	LUBE OIL (HIGH PRESSURE)
		CW	CLARIFIED WATER

SERVICE CLASS

SERVICE CLASS	MATERIAL	FLUID SYMBOL
AA40	IIR RUBBER LINED PIPING	LS, WP, WC
AA60	IIR RUBBER LINED PIPING	GS,FS,WW,DD
BA01	Gr.304 STAINLESS STEEL / GI PIPING	AI, LOL
BA02	Gr.304 STAINLESS STEEL / GI PIPING	LOH
BA03	Gr.316L STAINLESS STEEL PIPING	WP, AO
CA01	CARBON STEEL GENERAL PIPING	AS,AO,AC,AF,LD
CC01	CARBON STEEL PRESSURE PIPING	WP,WR,WCS,WCR, VG, AA
DA60	FRP PIPING (PIPE DIA UPTO 400 NB)	GS,FS,WW,DD
DA40	FRP PIPING (PIPE DIA UPTO 400 NB)	LS, WP, WC

UNIT CODE

SYMBOLS	UNIT IDENTIFICATION
00	COMMON
10	UNIT-1 FGD SYSTEM AND AUXILIARIES
20	UNIT-2 FGD SYSTEM AND AUXILIARIES

EXPRESSION OF PIPING LINE

10 - 200 - GS - 2 00 1 - AA60 - HF

- 10: UNIT CODE
- 200: NOMINAL PIPE SIZE (mm)
- GS: FLUID SYMBOL
- 2: SYSTEM NUMBER
- 00: SERIAL NUMBER
- 1: SUFFIX NUMBER
- AA60: PIPING SERVICE CLASS
- HF: INSULATION CLASS

LARA SUPER THERMAL POWER PROJECT
STAGE-II (2 X 800 MW)
Doc No-GDWE-508-571-PID

शीर्षक/TITLE
PROCESS P&I DIAGRAM
SYMBOL MARK (1/2)

विभाग DEPT.	स्केल - SCALE-	ड्राइंग संख्या/ DRAWING NO. 4540-001-109-PVM-L-001
हस्ताक्षर SIGN		File No. B240-00001
दिनांक DATE		शीट SHEET 1 OF 2 — पुनरीक्षण REV. 0

फॉर्मेट साइज A3
FORMAT SIZE A3

ELECTRONIC FILE NAME : B240-00001_Symbol_1.dwg

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि॰ मी॰ मे है/ALL DIMENSIONS ARE IN MM

INSTRUMENT ABBREVIATION

	FIRST–LETTER		SUCCEEDING–LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		BLANK	BLANK	BLANK
C	BLANK			CONTROL	
D	BLANK	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	BLANK		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	BLANK	MOMENTARY			MIDDLE, INTERMEDIATE
N	BLANK		BLANK	BLANK	BLANK
O	BLANK		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT(TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

INSTRUMENT SYMBOLS

SYMBOLS	NAME
	FIELD MOUNTED
	FOR CONTROL ROOM
	FOR LOCAL CONTROL PANEL
	FOR DCS
	INTERLOCK LOGIC

PNEUMATIC VALVE ACTUATOR

CODE NO.	ACTUATION
FLXXWA–D	DOUBLE SOLENOID NO LIMIT SWITCH
FLXXWA–DL	DOUBLE SOLENOID WITH LIMIT SWITCH
FLXXWA–S	SINGLE SOLENOID NO LIMIT SWITH
FLXXWA–SL	SINGLE SOLENOID WITH LIMIT SWITCH

MACHINARY SYMBOLS

SYMBOLS	NAME
	PUMP
	FAN / BLOWER
	AGITATOR (FLAT BLADE)
	AGITATOR (PROPELLOR)
	ROTARY VALVE
	CRUSHER
	BELT FEEDER
	BELT FILTER
	BALL MILL
	CYCLONE
	MIST ELIMINATOR
	DISTRIBUTION BOX

EQUIPMENT SYMBOLS

SYMBOLS	NAME
	BAG FILTER
	SILO
	SLIDE/KNIFE EDGE GATE
	TANDEM LOUVER DAMPER (MULTIVANE)
	SINGLE STAGE LOUVER DAMPER (MULTIVANE)
	LOUVER DAMPER (SINGLE VANE)
	DISTRIBUTION BOX (3WAY)
	DISTRIBUTION BOX (2WAY)
	SUMP
	HEAT EXCHANGER
	SHELL AND TUBE HEAT EXCHANGER
	AIR DRYER
	FILTER
	SPRAY NOZZLE
	ROD GATE

DRIVER SYMBOLS

SYMBOLS	NAME
A	AIR MOTOR
M	ELECTRIC MOTOR

OTHER SYMBOLS

SYMBOLS	NAME
	INSERT PIPE / LANCE
	CHUTE
	TRUCK

LARA SUPER THERMAL POWER PROJECT
STAGE-II (2 X 800 MW)
Doc No-GDWE-508-571-PID

PROCESS P&I DIAGRAM
SYMBOL MARK (2/2)

DRAWING NO. 4540-001-109-PVM-L-001

File No. 8240-00002

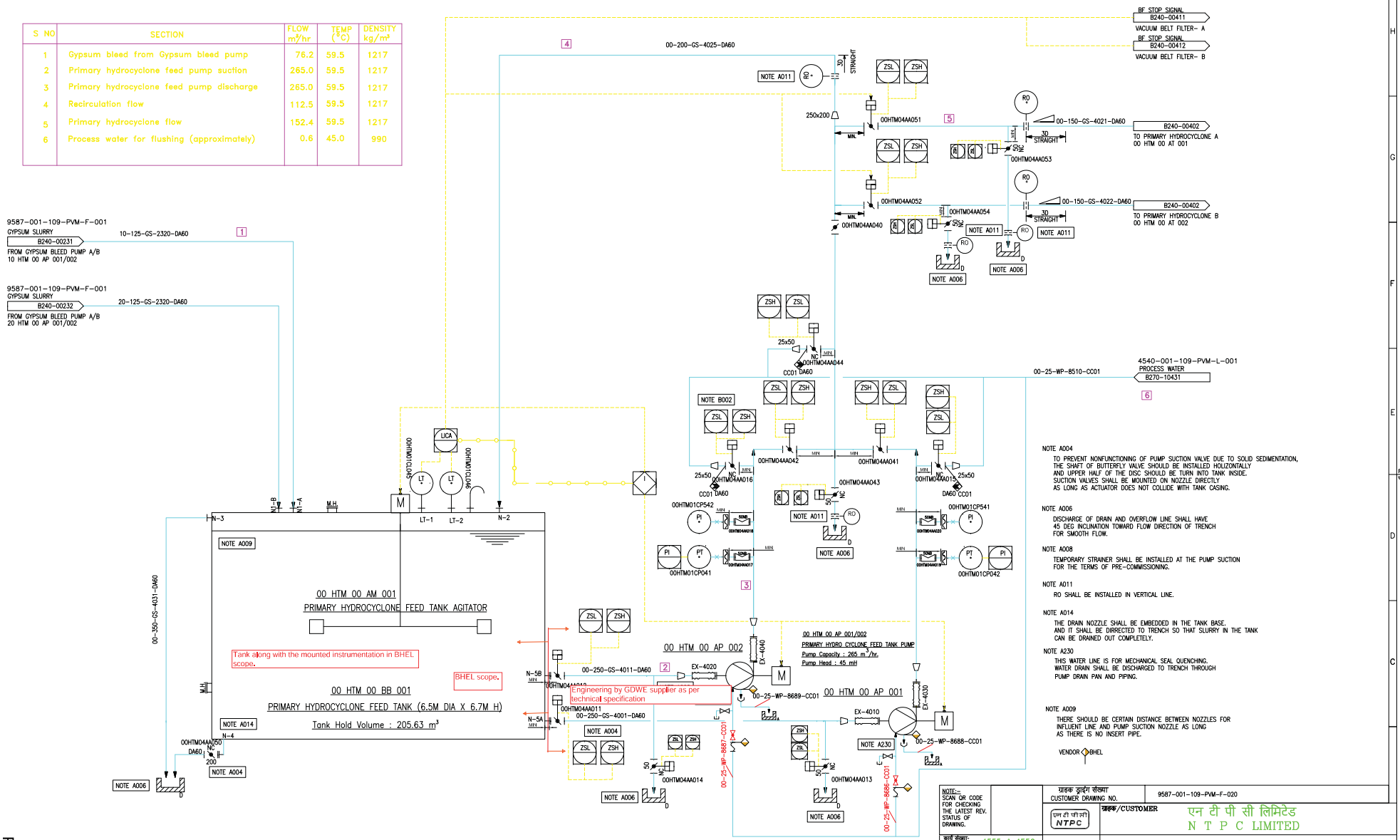
SHEET 2 OF 2

REV. 0

FORMAT SIZE A3

ELECTRONIC FILE NAME : 8240-00002_Symbol_2.dwg

S NO	SECTION	FLOW m³/hr	TEMP (°C)	DENSITY kg/m³
1	Gypsum bleed from Gypsum bleed pump	76.2	59.5	1217
2	Primary hydrocyclone feed pump suction	265.0	59.5	1217
3	Primary hydrocyclone feed pump discharge	265.0	59.5	1217
4	Recirculation flow	112.5	59.5	1217
5	Primary hydrocyclone flow	152.4	59.5	1217
6	Process water for flushing (approximately)	0.6	45.0	990



NOTE A004

TO PREVENT NONFUNCTIONING OF PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HOLIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.

NOTE A006

DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE A008

TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.

NOTE A011

RO SHALL BE INSTALLED IN VERTICAL LINE.

NOTE A014

THE DRAIN NOZZLE SHALL BE EMBEDDED IN THE TANK BASE. AND IT SHALL BE DIRRECTED TO TRENCH SO THAT SLURRY IN THE TANK CAN BE DRAINED OUT COMPLETELY.

NOTE A230

THIS WATER LINE IS FOR MECHANICAL SEAL QUENCHING. WATER DRAIN SHALL BE DISCHARGED TO TRENCH THROUGH PUMP DRAIN PAN AND PIPING.

NOTE A009

THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.

VENDOR ◆ BHEL

NOTE:-
SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक/CUSTOMER
एन टी पी सी लिमिटेड
N T P C LIMITED

कार्य संख्या- JOB NO. 1555 & 1556
स्थिति STATUS CONTRACT
परियोजना PROJECT
LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

मुद्रण स्केल मीटर में PRINT SCALE IN METRE
0 2 4 6 8 10 20 30 40 50

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE -

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	KMK	-SD-	21-02-24
डिजाइनकर्ता/DESN	KMK	-SD-	21-02-24
जांचकर्ता/CHD	OS	-SD-	21-02-24
अनुमोदनकर्ता/APPD	ACR	-SD-	21-02-24

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD

शीर्षक/TITLE
PROCESS P&I DIAGRAM
PRIMARY HYDRO CYCLONE FEED TANK

विभाग DEPT. स्केल SCALE -
हस्ताक्षर SIGN
दिनांक DATE
ड्राइंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020
File No. B240-00401
शीट SHEET 1 OF 12
पुनरीक्षण REV. 0
फॉर्मेट साइज A3
FORMAT SIZE A3

ड्राइंग संख्या/DRAWING NO.

ELECTRONIC FILE NAME : B240-00401_Primary_Hydrocyclone_Feed_Tank.dwg

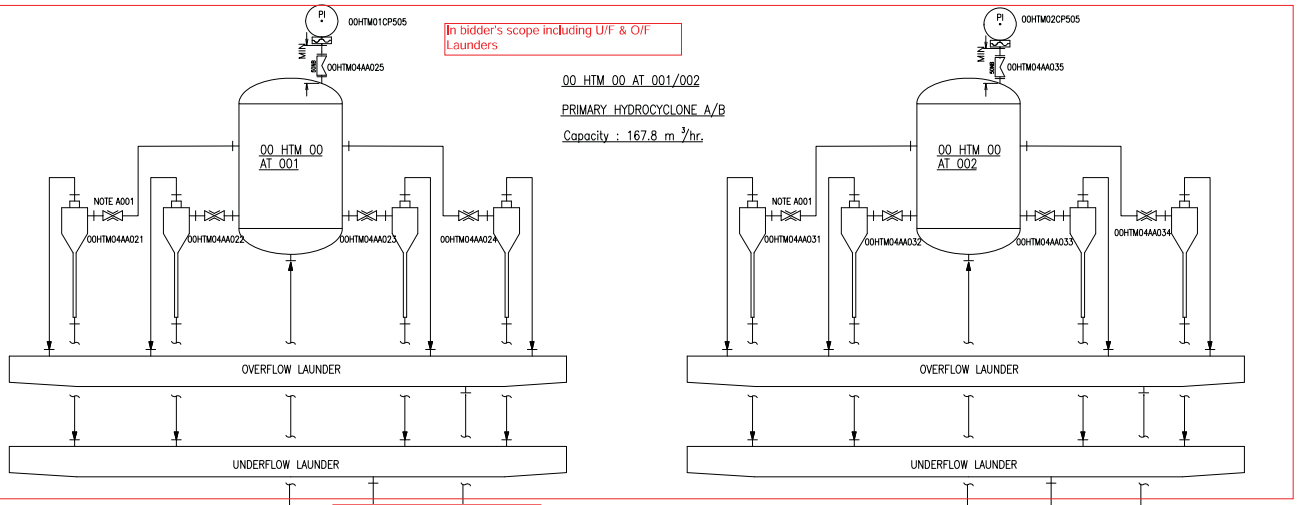
ड्राइंग संख्या/DRAWING NO.

In bidder's scope including U/F & O/F Launders

00 HTM 00 AT 001/002

PRIMARY HYDROCYCLONE A/B

Capacity : 167.8 m³/hr.



Engineering and supplied by bidder

Engineering and supplied by bidder

Engineering and supplied by bidder

Engineering and supplied by bidder

Engineering by bidder as per specification

Engineering by bidder as per specification

Engineering by bidder as per specification

Engineering by bidder as per specification

NOTE:A001
NUMBER OF VALVES & HYDROCYCLONES SHALL BE FINALIZED AFTER GDS VENDOR'S INFORMATION DETAILS ARE REQUIRED FROM PEM VENDOR

3 00-250-GS-4051-DA60
B240-00442
TO SECONDARY HYDROCYCLONE FEED TANK 00 HTM 04 BB 001

1 00-150-GS-4021-DA60
B240-00401
FROM PRIMARY HYDROCYCLONE FEED TANK PUMP A/B 00 HTM 00 AP 001/002

Engineering and supplied by bidder

Engineering and supplied by bidder

2 00-200-GS-4052-AA60
B240-00412
TO GYPSUM BELT FILTER B 00 HTM 01 AT 002

S NO	SECTION	FLOW m³/hr	TEMP (°C)	DENSITY kg/m³
1	Primary hydrocyclone feed flow	152.4	59.5	1217
2	Primary hydrocyclone underflow	64.4	59.5	1359
3	Primary hydrocyclone overflow	88.0	59.5	1113

3 00-250-GS-4041-DA60
B240-00442
TO SECONDARY HYDROCYCLONE FEED TANK 00 HTM 04 BB 001

2 00-200-GS-4042-AA60
B240-00411
TO GYPSUM BELT FILTER A 00 HTM 01 AT 001

1 00-150-GS-4022-DA60
B240-00401
FROM PRIMARY HYDROCYCLONE FEED TANK PUMP A/B 00 HTM 00 AP 001/002

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED

कार्य संख्या-JOB NO. 1555 & 1556

स्थिति STATUS CONTRACT

परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

मुद्रण स्केल मीटर में PRINT SCALE IN METRE 0 2 4 6 8 10 20 30 40 50

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
–	तैयारकर्ता/DRN	KMK	-SD-	21-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	21-02-24
	जांचकर्ता/CHD	OS	-SD-	21-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	21-02-24

शीर्षक/TITLE
PROCESS P&I DIAGRAM
PRIMARY HYDRO CYCLONE

विभाग DEPT. | स्केल SCALE – | इंजीनियर SIGN | दिनांक DATE

ड्राइंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020

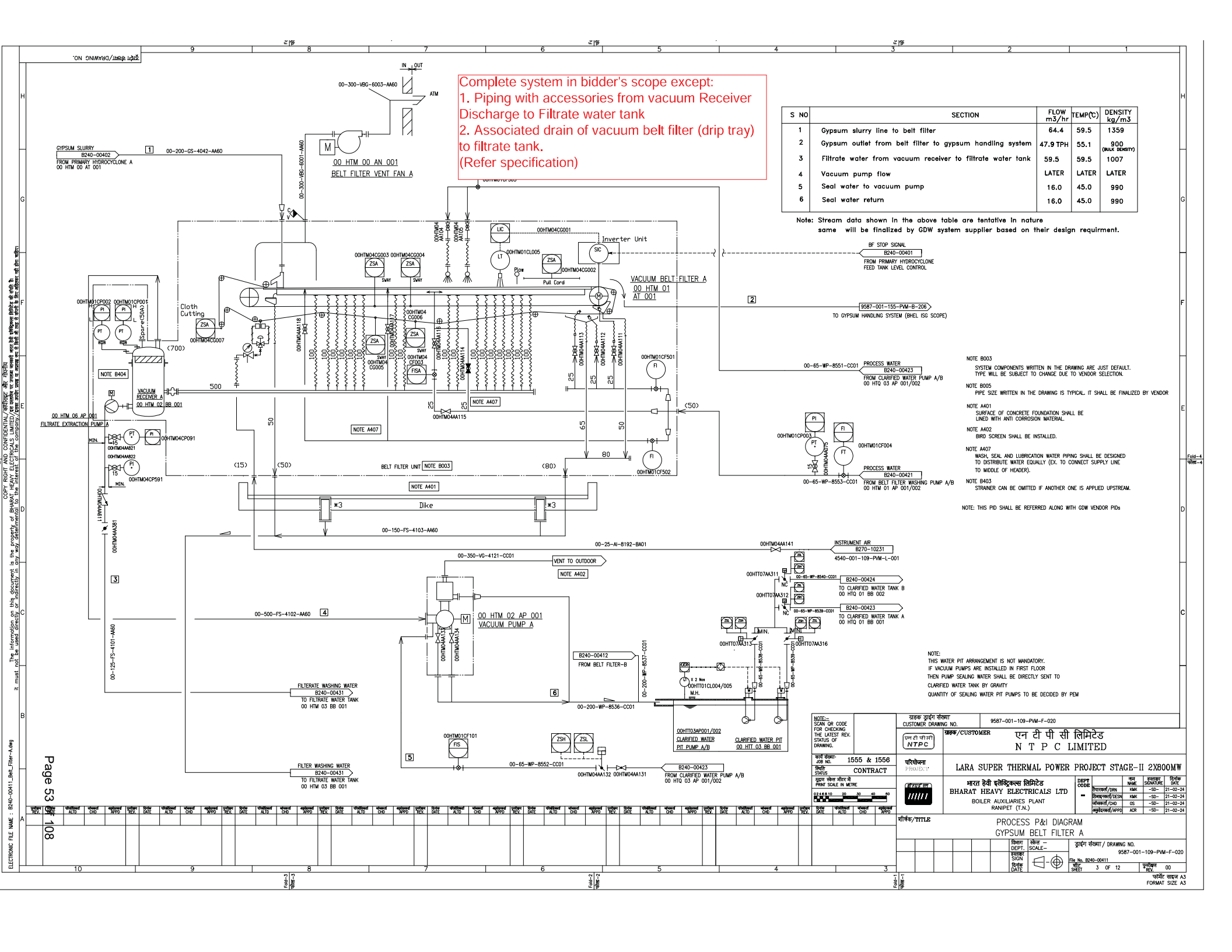
File No. B240-00402

शीट SHEET 2 OF 12 | पुनरीक्षण REV. 00

फॉर्मेट साइज़ A3 FORMAT SIZE A3

REV.	DATE	तैयारकर्ता PREP	जांचकर्ता CHD	अनुमोदनकर्ता APPD
00	21-02-24	KMK	OS	ACR

ELECTRONIC FILE NAME : B240-00402_Primary_hydrocyclone.dwg



S NO	SECTION	FLOW m3/hr	TEMP(C)	DENSITY kg/m3
1	Gypsum slurry line to belt filter	64.4	59.5	1359
2	Gypsum outlet from belt filter to gypsum handling system	47.9 TPH	55.1	900 (BULK DENSITY)
3	Filtrate water from vacuum receiver to filtrate water tank	59.5	59.5	1007
4	Vacuum pump flow	LATER	LATER	LATER
5	Seal water to vacuum pump	16.0	45.0	990
6	Seal water return	16.0	45.0	990

ELECTRONIC FILE NAME : B240-00411_Belt_Filter-A.dwg

Complete system in bidder's scope except:
1. Piping with accessories from vacuum Receiver Discharge to Filtrate water tank
2. Associated drain of vacuum belt filter (drip tray) to filtrate tank.
(Refer specification)

S NO	SECTION	FLOW m3/hr	TEMP(℃)	DENSITY kg/m3
1	Gypsum slurry line to belt filter	64.4	59.5	1359
2	Gypsum outlet from belt filter to gypsum handling system	47.9 TPH	55.1	900 (BULK DENSITY)
3	Filtrate water from vacuum receiver to filtrate water tank	59.5	59.5	1007
4	Vacuum pump flow	LATER	LATER	LATER
5	Seal water to vacuum pump	16.0	45.0	990
6	Seal water return	16.0	45.0	990

Note: Stream data shown in the above table are tentative in nature same will be finalized by GDW system supplier based on their design requirment.

GYPSUM SLURRY B240-00402 FROM PRIMARY HYDROCYCLONE B 00 HTM 00 AT 002

00-200-GS-4052-AA60

00-300-VBG-6011-AA60

00 HTM 00 AN 002 BELT FILTER VENT FAN B

00HTM02CF503

NOTE A406

00HTM04AA204 00HTM04AA205

LIC 00HTM04CG011

NOTE A001

Inverter Unit

00HTM02CL005

SIC

00HTM04CG012

Pull Cord

00HTM04CG013 00HTM04CG014

ZSA SWAY

VACUUM BELT FILTER B 00 HTM 01 AT 002

NOTE B405

BF STOP SIGNAL B240-00401 FROM PRIMARY HYDROCYCLONE FEED TANK LEVEL CONTROL

9587-001-155-PVM-B-206 TO GYPSUM HANDLING SYSTEM (BHEL ISG SCOPE)

NOTE A405

00HTM02CP002 00HTM02CP001

PI PT

Spare(SOA)

Cloth Cutting

00HTM04CG017

00HTM04CG016 00HTM04CG015 00HTM04CG013

FISA

00HTM04AA218 00HTM04AA217 00HTM04AA216 00HTM04AA214 00HTM04AA213 00HTM04AA212 00HTM04AA211

(900)

NOTE B404

VACUUM RECEIVER B 00 HTM 02 BB 002

500

00HTM02CF501

00HTM04AA215

NOTE A407

00 HTM 06 AP 002 FILTRATE EXTRACTION PUMP B

00HTM04CP092

00HTM04AA823 00HTM04AA824

00HTM04CP592

BELT FILTER UNIT NOTE B003

(15) (50) (80)

NOTE A401

*3 Dike *3

00-150-FS-4113-AA60

00HTM04AA382

00HTM02CP003

00HTM02CF004

00HTM04AA076

PROCESS WATER B240-00421 FROM BELT FILTER WASHING PUMP A/B 00 HTM 01 AP 001/002

00-65-WP-8554-CC01

PROCESS WATER B240-00424 FROM CLARIFIED WATER PUMP A/B 00 HTQ 04 AP 001/002

00-65-WP-8552-CC01

00-25-AI-8193-BA01

INSTRUMENT AIR B270-10231 4540-001-109-PVM-L-001

00HTM04AA241

00-350-VG-4131-CC01

VENT TO OUTDOOR NOTE A402

00-500-FS-4112-AA60

00 HTM 02 AP 002 VACUUM PUMP B

00HTM04AA233 00HTM04AA234

00-125-FS-4111-AA60

FILTERATE WASHING WATER B240-00431 TO FILTRATE WATER TANK 00 HTM 03 BB 001

00-200-WP-8537-CC01

B240-00411 TO BELT FILTER – A

NOTE B002

00HTM01CF102

FIS ZSH ZSL

00-65-WP-8554-CC01

00HTM04AA232 00HTM04AA231

PROCESS WATER B240-00424 FROM CLARIFIED WATER PUMP C/D 00 HTQ 04 AP 001/002

FILTER WASHING WATER B240-00431 TO FILTRATE WATER TANK 00 HTM 03 BB 001

NOTE B003
SYSTEM COMPONENTS WRITTEN IN THE DRAWING ARE JUST DEFAULT. TYPE WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION.

NOTE B005
PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHALL BE FINALIZED BY VENDOR

NOTE A401
SURFACE OF CONCRETE FOUNDATION SHALL BE LINED WITH ANTI CORROSION MATERIAL.

NOTE A402
BIRD SCREEN SHALL BE INSTALLED.

NOTE A407
WASH, SEAL AND LUBRICATION WATER PIPING SHALL BE DESIGNED TO DISTRIBUTE WATER EQUALLY (EX. TO CONNECT SUPPLY LINE TO MIDDLE OF HEADER).

NOTE B403
STRAINER CAN BE OMITTED IF ANOTHER ONE IS APPLIED UPSTREAM.

NOTE: THIS PID SHALL BE REFERRED ALONG WITH GDW VENDOR PIDs

NOTE:– SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या-JOB NO. 1555 & 1556
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED

परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
–	तैयारकर्ता/DRN	KMK	-SD-	21-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	21-02-24
	जांचकर्ता/CHD	OS	-SD-	21-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	21-02-24

शीर्षक/TITLE
PROCESS P&I DIAGRAM
GYPSUM BELT FILTER B

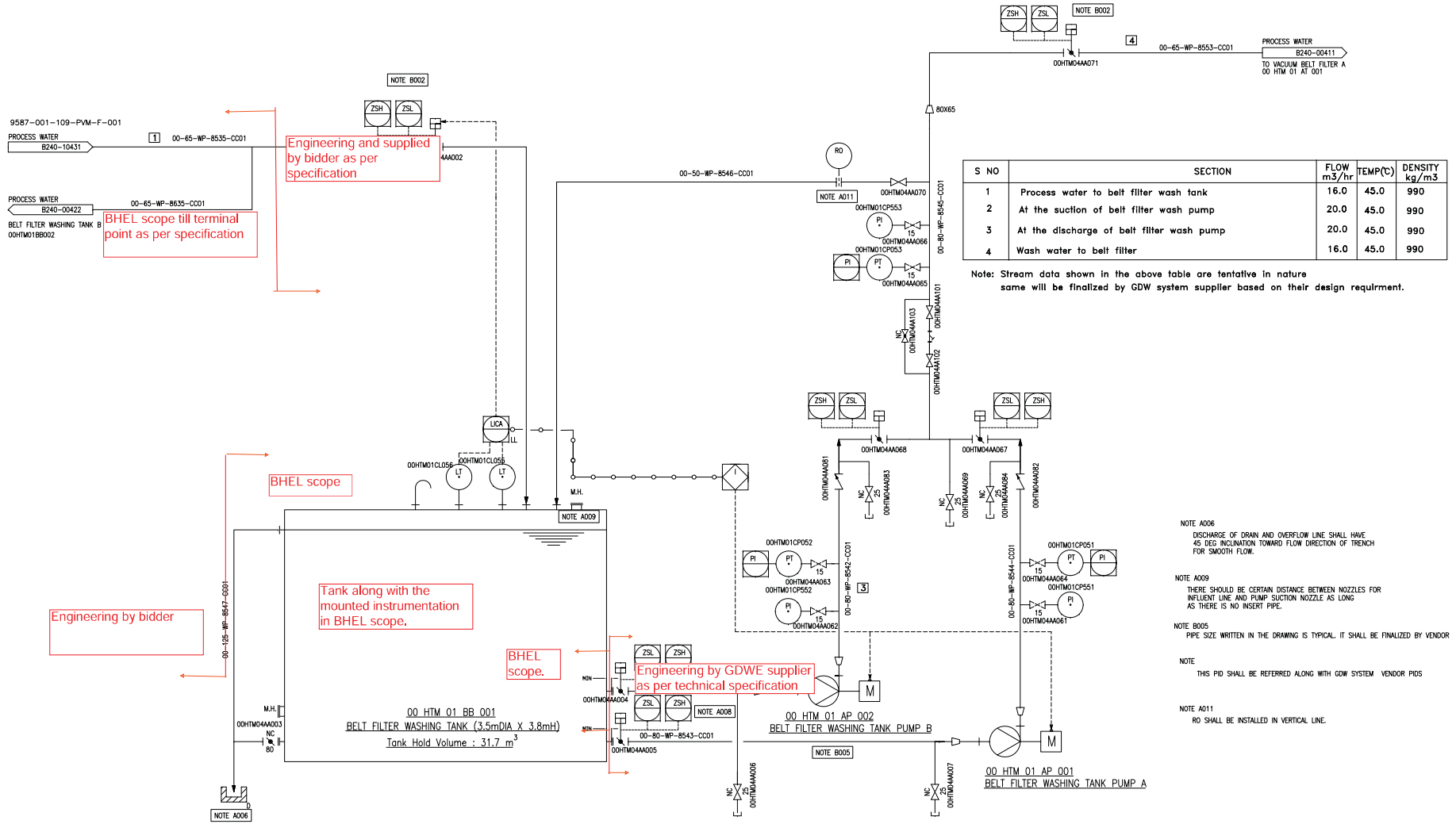
विभाग DEPT. स्केल – SCALE–
इंजीनियर SIGN
दिनांक DATE

ड्राईंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020
File No. B240-00412
शीट SHEET 4 OF 12
पुनरीक्षण REV. 00

फॉर्मेट साइज A3 FORMAT SIZE A3

ड्राफ्ट्समैन DRN	दिनांक DATE	परीक्षणकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.

ELECTRONIC FILE NAME : B240-00412_Belt_Filter-B.dwg



S NO	SECTION	FLOW m3/hr	TEMP(℃)	DENSITY kg/m3
1	Process water to belt filter wash tank	16.0	45.0	990
2	At the suction of belt filter wash pump	20.0	45.0	990
3	At the discharge of belt filter wash pump	20.0	45.0	990
4	Wash water to belt filter	16.0	45.0	990

Note: Stream data shown in the above table are tentative in nature same will be finalized by GDW system supplier based on their design requirment.

NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.

NOTE B005
PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHALL BE FINALIZED BY VENDOR

NOTE
THIS PID SHALL BE REFERRED ALONG WITH GDW SYSTEM VENDOR PIDS

NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.

ELECTRONIC FILE NAME : B240-00421_Belt_Filter_Washing_Tank-A.dwg

Page 55 108

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड N T P C LIMITED

कार्य संख्या-JOB NO. 1555 & 1556

स्थिति STATUS: CONTRACT

परियोजना PROJECT: LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
-	तैयारकर्ता/DRN	KMK	-SD-	21-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	21-02-24
	जांचकर्ता/CHD	OS	-SD-	21-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	21-02-24

शीर्षक/TITLE
PROCESS P&I DIAGRAM
BELT FILTER WASHING TANK A

विभाग DEPT. | स्केल SCALE: – | इंजीनियर SIGN | दिनांक DATE

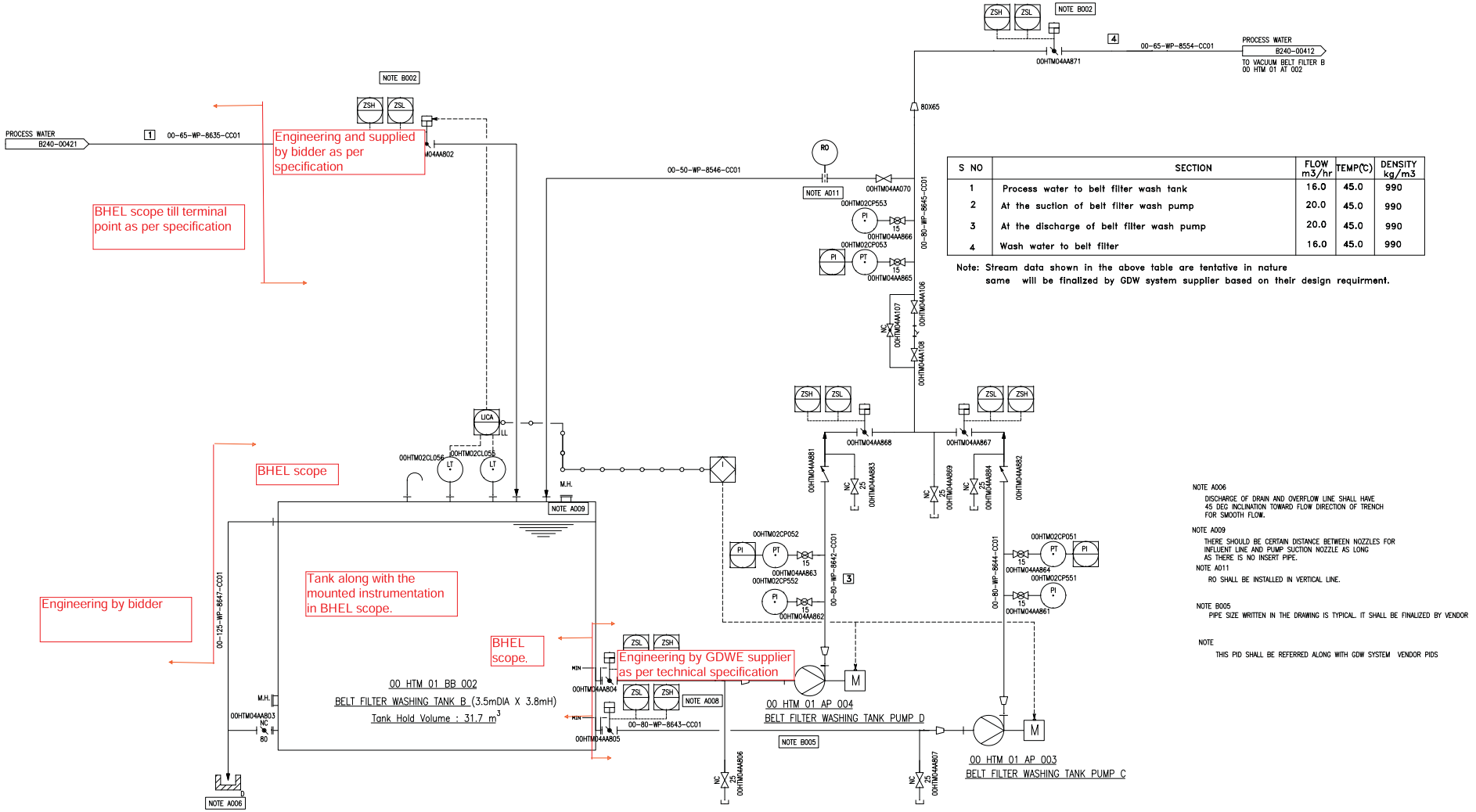
ड्राईंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020

File No. B240-00421

शीट SHEET 5 OF 12

पुनरीक्षण REV. 0

फॉर्मेट साइज A3
FORMAT SIZE A3



S NO	SECTION	FLOW m3/hr	TEMP(℃)	DENSITY kg/m3
1	Process water to belt filter wash tank	16.0	45.0	990
2	At the suction of belt filter wash pump	20.0	45.0	990
3	At the discharge of belt filter wash pump	20.0	45.0	990
4	Wash water to belt filter	16.0	45.0	990

Note: Stream data shown in the above table are tentative in nature same will be finalized by GDW system supplier based on their design requirment.

NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.

NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.

NOTE B005
PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHALL BE FINALIZED BY VENDOR

NOTE
THIS PID SHALL BE REFERRED ALONG WITH GDW SYSTEM VENDOR PIDS

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO.	9587-001-109-PVM-F-020
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
कार्य संख्या-JOB NO.	1555 & 1556
स्थिति STATUS	CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE	0 2 4 6 8 10 20 30 40 50
परियोजना PROJECT	LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW
	भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET (T.N.)

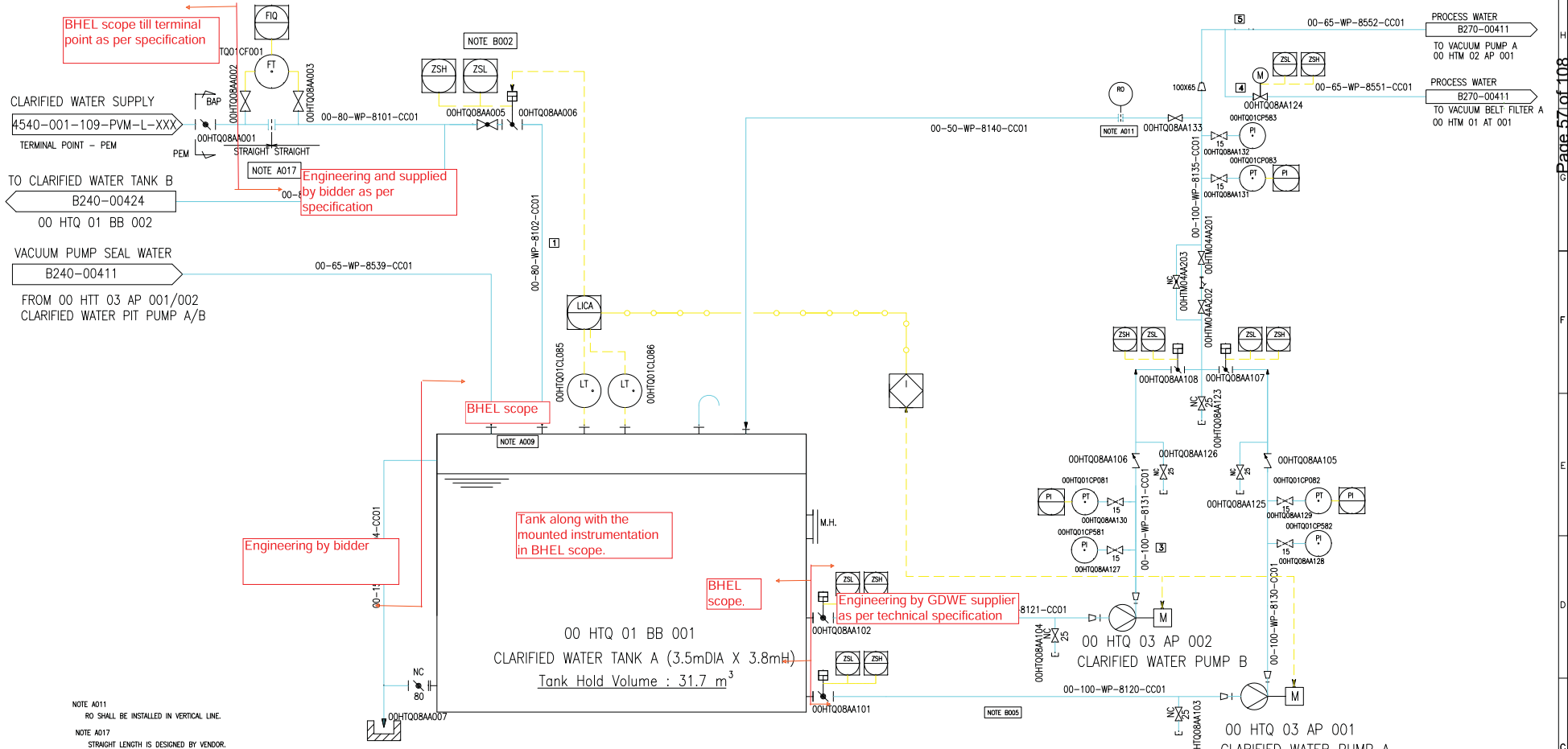
DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
-	तैयारकर्ता/DRN	KMK	-SD-	22-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	22-02-24
	जांचकर्ता/CHD	OS	-SD-	22-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	22-02-24

शीर्षक/TITLE
PROCESS P&I DIAGRAM
BELT FILTER WASHING TANK B

विभाग DEPT.	स्केल – SCALE–
ड्राईंग संख्या / DRAWING NO.	9587-001-109-PVM-F-020
File No. B240-00422	
शीट SHEET	6 OF 12
पुनरीक्षण REV.	0

फॉर्मेट साइज A3
FORMAT SIZE A3

ELECTRONIC FILE NAME : B240-00422_Belt_Filter_Washing_Tank-B.dwg



NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.

NOTE A017
STRAIGHT LENGTH IS DESIGNED BY VENDOR.

NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.

NOTE B005
PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHALL BE FINALIZED BY VENDOR

NOTE THIS PID SHALL BE REFERRED ALONG WITH GDWS VENDOR PIDS

S NO	SECTION	FLOW m3/hr	TEMP(C)	DENSITY kg/m3
1	Clarified water to clarified wash tank	16.0	45.0	990
2	At the suction of clarified wash pump	40.0	45.0	990
3	At the discharge of clarified wash pump	40.0	45.0	990
4	Clarified Wash water to belt filter	16.0	45.0	990
5	Vacuum pump seal water	16.0	45.0	990

Note: Stream data shown in the above table are tentative in nature same will be finalized by GDW system supplier based on their design requirment.

ELECTRONIC FILE NAME : B240-00423_Clarified_Water_Tank-A.dwg

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक द्वारा संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक CUSTOMER: एन टी पी सी लिमिटेड N T P C LIMITED

कार्य संख्या-JOB NO. 1555 & 1556

स्थिति STATUS CONTRACT

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

परियोजना PROJECT: LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	KMK	-SD-	22-02-23
डिजाइनकर्ता/DESN	KMK	-SD-	22-02-23
जांचकर्ता/CHD	OS	-SD-	22-02-23
अनुमोदनकर्ता/APPD	ACR	-SD-	22-02-23

शीर्षक TITLE: PROCESS P&I DIAGRAM CLARIFIED WATER TANK A

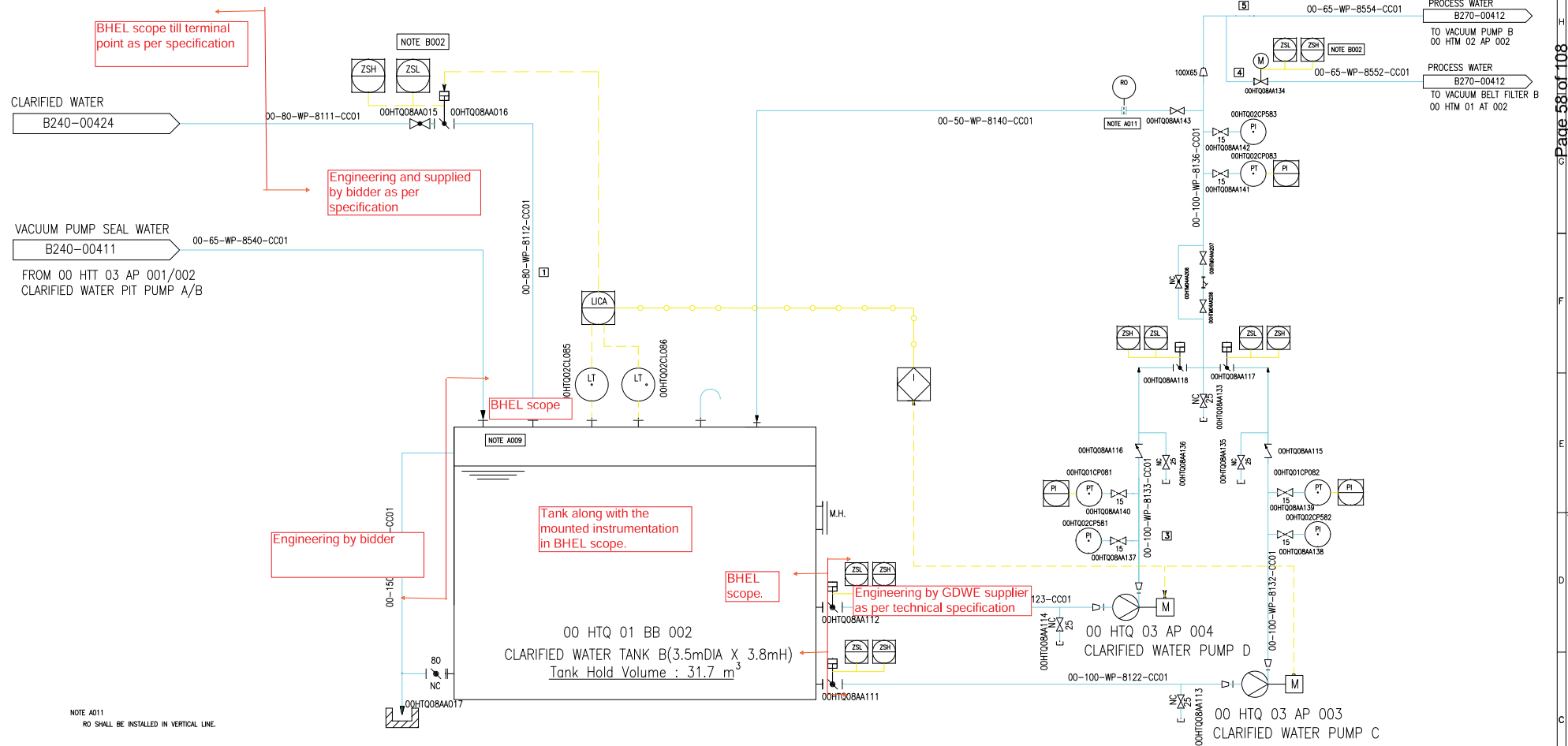
ड्राइंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020

File No. B240-00423

शीट SHEET 7 OF 12

पुनरीक्षण REV. 0

फॉर्मेट साइज A3 FORMAT SIZE A3



NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.

NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE B005
PIPE SIZE WRITTEN IN THE DRAWING IS TYPICAL. IT SHALL BE FINALIZED BY VENDOR

NOTE
THIS PID SHALL BE REFERRED ALONG WITH GDW SYSTEM VENDOR PIDS

NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.

S NO	SECTION	FLOW m3/hr	TEMP(°C)	DENSITY kg/m3
1	Clarified water to clarified wash tank	16.0	45.0	990
2	At the suction of clarified wash pump	40.0	45.0	990
3	At the discharge of clarified wash pump	40.0	45.0	990
4	Clarified Wash water to belt filter	16.0	45.0	990
5	Vacuum pump seal water	16.0	45.0	990

Note: Stream data shown in the above table are tentative in nature same will be finalized by GDW system supplier based on their design requirment.

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक / CUSTOMER: एन टी पी सी लिमिटेड N T P C LIMITED

कार्य संख्या-JOB NO. 1555 & 1556

स्थिति STATUS: CONTRACT

परियोजना PROJECT: LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
-	तैयारकर्ता/DRN	KMK	-SD-	22-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	22-02-24
	जांचकर्ता/CHD	OS	-SD-	22-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	22-02-24

शीर्षक / TITLE: PROCESS P&I DIAGRAM CLARIFIED WATER TANK B

ड्राईंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020

File No. B240-00424

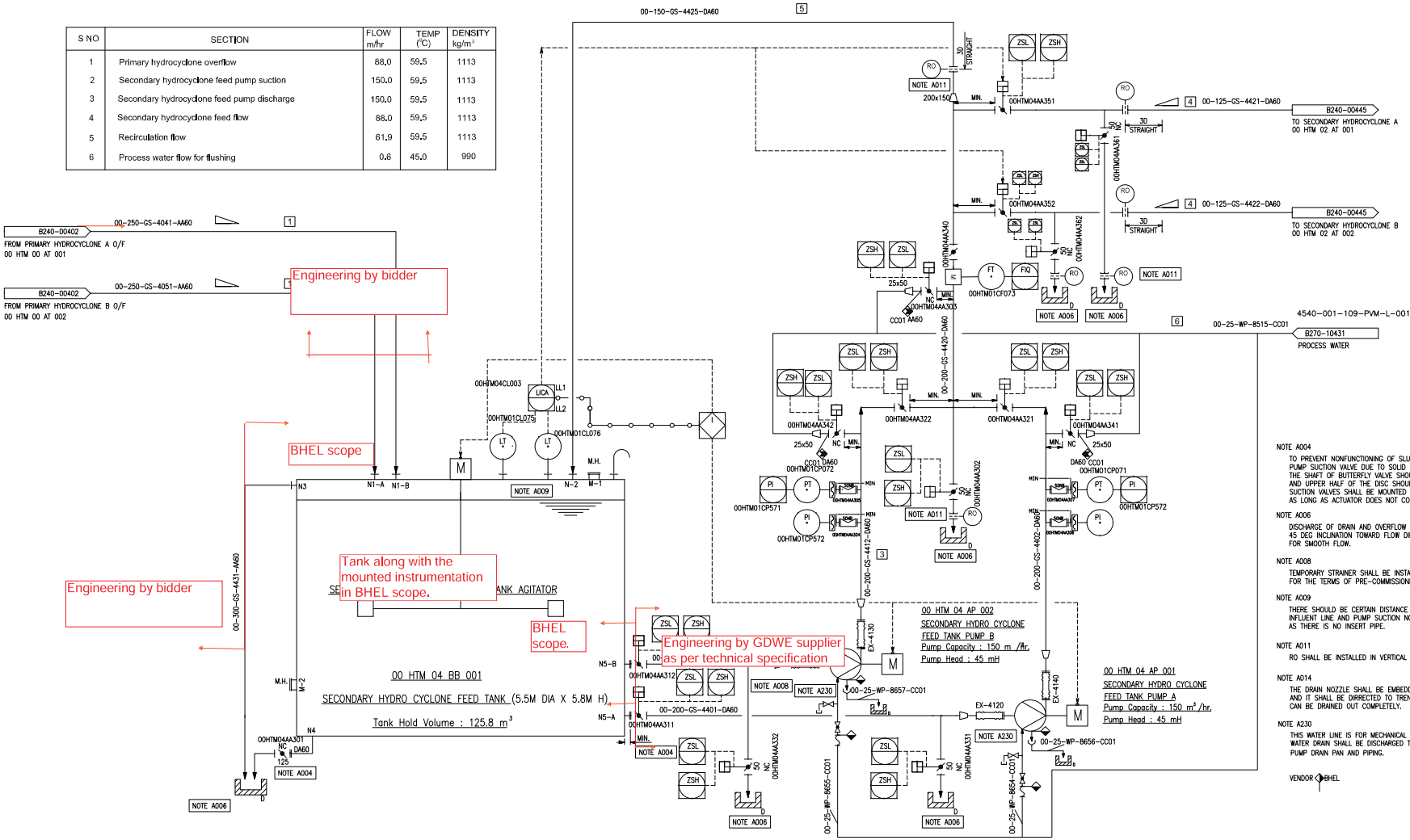
शीट SHEET 8 OF 12

पुनरीक्षण REV. 0

फॉर्मेट साइज A3 FORMAT SIZE A3

ELECTRONIC FILE NAME : B240-00424_Clarified_Water_Tank-B.dwg

S NO	SECTION	FLOW m/hr	TEMP (°C)	DENSITY kg/m³
1	Primary hydrocyclone overflow	88.0	59.5	1113
2	Secondary hydrocyclone feed pump suction	150.0	59.5	1113
3	Secondary hydrocyclone feed pump discharge	150.0	59.5	1113
4	Secondary hydrocyclone feed flow	88.0	59.5	1113
5	Recirculation flow	61.9	59.5	1113
6	Process water flow for flushing	0.6	45.0	990



NOTE:– SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO.	9587-001-109-PVM-F-020
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
कार्य संख्या- JOB NO.	1555 & 1556
स्थिति STATUS	CONTRACT
परियोजना PROJECT	LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW
मुद्रण स्केल मीटर में PRINT SCALE IN METRE	0 2 4 6 8 10 20 30 40 50
	भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD BOILER AUXILIARIES PLANT RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
–	तैयारकर्ता/DRN	KMK	-SD-	22-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	22-02-24
	जांचकर्ता/CHD	OS	-SD-	22-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	22-02-24

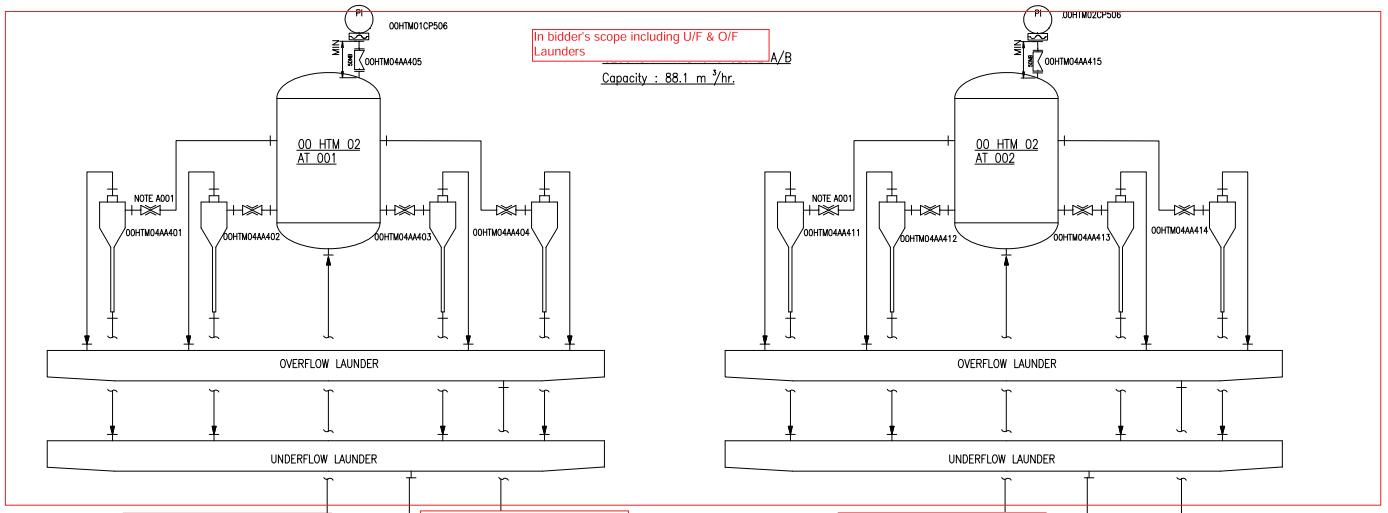
शीर्षक/TITLE
PROCESS P&I DIAGRAM
SECONDARY HYDRO CYCLONE FEED TANK

विभाग DEPT.	स्केल SCALE –
हस्ताक्षर SIGN	ड्राईंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020
दिनांक DATE	File No. B240-00441
	शीट SHEET 10 OF 12
	पुनरीक्षण REV. 00

फॉर्मेट साइज A3
FORMAT SIZE A3

REV.	DATE	ALTD	CHD	APPD

ELECTRONIC FILE NAME : B240-00441_Secondary hydrocyclone_Feed_Tank.dwg



Engineering and supplied by bidder

Engineering and supplied by bidder

Engineering and supplied by bidder

Engineering and supplied by bidder

Engineering by bidder as per specification

Engineering by bidder as per specification

Engineering by bidder as per specification

Engineering by bidder as per specification

GYPSUM SLURRY
B240-00441
FROM SECONDARY HYDROCYCLONE FEED TANK PUMP A/B
00 HTM 04 AP 001/002
1
00-125-GS-4421-DA60

3
00-200-FS-4451-DA60
SECONDARY HYDROCYCLONE B O/F
B240-00451
TO WASTE WATER STORAGE TANK
00 HTM 05 BB 001

2
00-150-GS-4452-AA60
SECONDARY HYDROCYCLONE B U/F
B240-00431
TO FILTRATE WATER TANK
00 HTM 03 BB 001

Engineering and supplied by bidder

00-200-FS-4441-DA60

Engineering and supplied by bidder

3
SECONDARY HYDROCYCLONE A O/F
B240-00451
TO WASTE WATER STORAGE TANK
00 HTM 05 BB 001

00-150-GS-4442-AA60

2
SECONDARY HYDROCYCLONE A U/F
B240-00431
TO FILTRATE WATER TANK
00 HTM 03 BB 001

GYPSUM SLURRY
B240-00441
FROM SECONDARY HYDROCYCLONE FEED TANK PUMP A/B
00 HTM 04 AP 001/002
1
00-125-GS-4422-DA60

S NO	SECTION	FLOW m^3/hr	TEMP (°C)	DENSITY kg/m^3
1	Secondary hydrocyclone feed flow	88.06	59.5	1113
2	Secondary hydrocyclone underflow	33.04	59.5	1261
3	Secondary hydrocyclone overflow	55.02	59.5	1024

NOTE:A001
NUMBER OF VALVES & HYDROCYCLONES SHALL BE FINALIZED AFTER GDS VENDOR'S INFORMATION DETAILS ARE REQUIRED FROM PEM VENDOR

NOTE:-
SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या-JOB NO. 1555 & 1556
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड
N T P C LIMITED

परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
-	तैयारकर्ता/DRN	KMK	-SD-	22-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	22-02-24
	जांचकर्ता/CHD	OS	-SD-	22-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	22-02-24

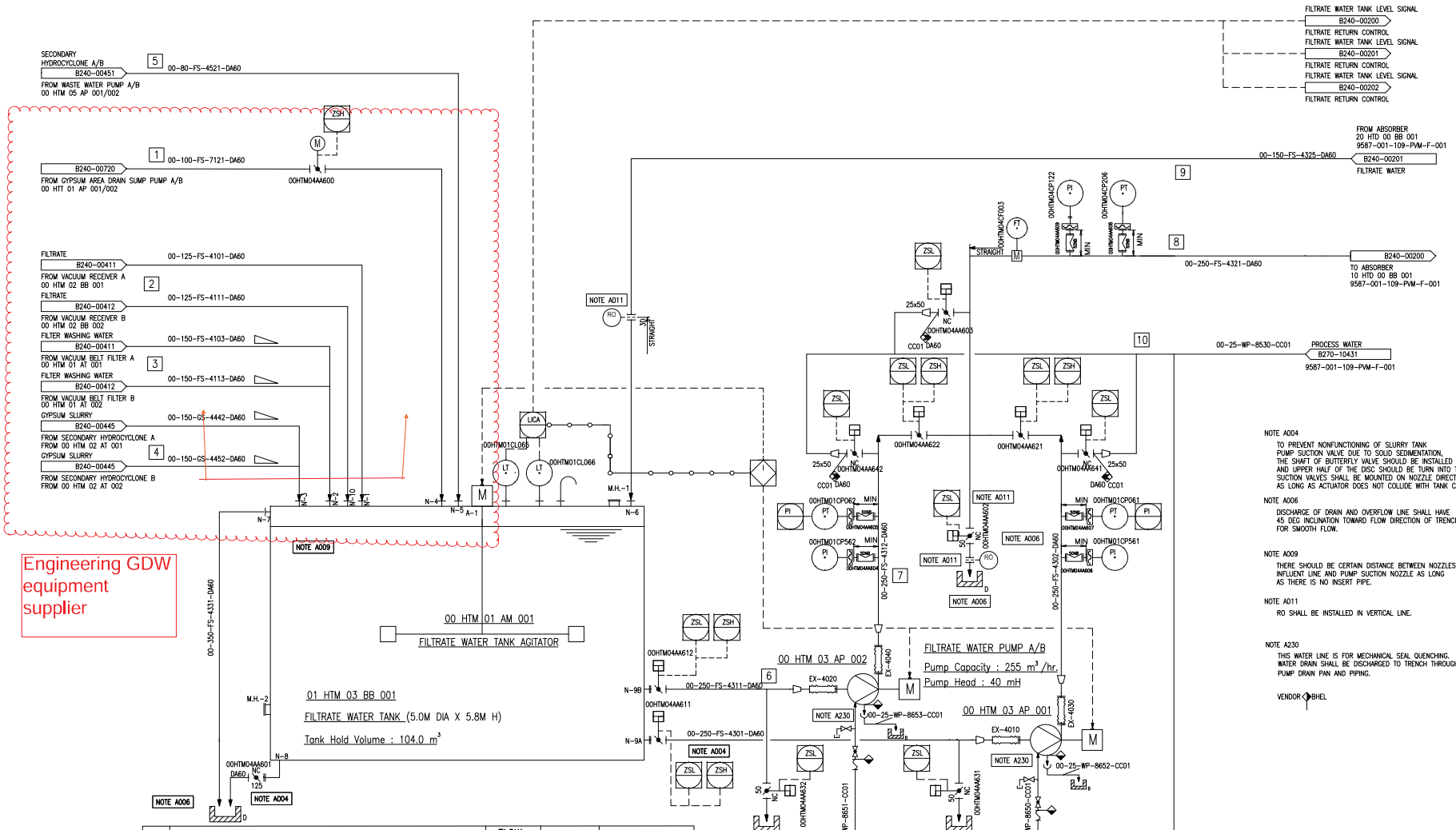
शीर्षक/TITLE
PROCESS P&I DIAGRAM
SECONDARY HYDRO CYCLONE

विभाग DEPT. | स्केल SCALE – | इंजीनियर SIGN | दिनांक DATE

ड्राईंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020
File No. B240-00445
शीट SHEET 11 OF 12
पुनरीक्षण REV. 00

फॉर्मेट साइज़ A3
FORMAT SIZE A3

ELECTRONIC FILE NAME : B240-00445_Secondary_Hydrocyclone.dwg



S NO	SECTION	FLOW m³/hr	TEMP(°C)	DENSITY(kg/m3)
1	Gypsum slurry from gypsum area drain sump pump	50.0	59.5	1217
2	Filtrate water from vacuum receiver	59.5	59.3	1007
3	Wash Water from vacuum belt filter	16.0	45.0	990
4	Underflow from sec waste water hydrocyclone	33.0	59.5	1261
5	Waste water slurry from waste water tank	35.5	57.3	1024
6	Suction line of filtrate tank pump	255.0	57.3	1067
7	Discharge line from filtrate pump	255.0	57.3	1067
8	Common discharge line to absorber	255.0	57.3	1067
9	Filtrate slurry from absorber	110.8	57.3	1067
10	Process water for flushing	0.6	45.0	990

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

ग्राहक ड्राईंग संख्या CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED

कार्य संख्या-JOB NO. 1555 & 1556

स्थिति STATUS CONTRACT

परियोजना PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

DEPT CODE		नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
-	तैयारकर्ता/DRN	KMK	-SD-	22-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	22-02-24
	जांचकर्ता/CHD	OS	-SD-	22-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	22-02-24

शीर्षक/TITLE
PROCESS P&I DIAGRAM
FILTRATE WATER TANK

विभाग DEPT. स्केल SCALE –

ड्राईंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020

File No. B240-00431

शीट SHEET 09 OF 12

पुनरीक्षण REV. 00

फॉर्मेट साइज A3
FORMAT SIZE A3

ELECTRONIC FILE NAME : B240-00431_Filtrate Water Tank.dwg

ELECTRONIC FILE NAME : B240-00451_Waste_Water_Storage_Tank.dwg

DRAWING NO. / चित्रण संख्या

B240-00448
9587-001-109-PVM-F-046

00-50-WC-8043-DA40

LIME DOSING TANK A/B
00 HTS 01 BB 001/002

B240-00448
9587-001-109-PVM-F-046

B240-00445
FROM SECONDARY HYDROCYCLONE A OVERFLOW
00 HTM 02 AT 001

00-200-FS-4441-DA60

B240-00445
FROM SECONDARY HYDROCYCLONE B OVERFLOW
00 HTM 02 AT 002

00-200-FS-4451-DA60

NOTE A004
TO PREVENT NONFUNCTIONING OF PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HOLIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.

NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.

NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.

NOTE A230
THIS WATER LINE IS FOR MECHANICAL SEAL QUENCHING. WATER DRAIN SHALL BE DISCHARGED TO TRENCH THROUGH PUMP DRAIN PAN AND PIPING.

NOTE THIS PID SHALL BE REFERRED ALONG WITH GDW VENDOR PIDS

VENDOR : BHEL

00 HTM 03 AM 001
WASTE WATER STORAGE TANK AGITATOR

00 HTM 05 BB 001
WASTE WATER STORAGE TANK (6.5m DIA X 6.7mH)
Tank Hold Volume : 205.63 m³

00 HTM 05 AP 002
WASTE WATER PUMP B
Pump Capacity : 80 m³/hr.
Pump Head : 30 mH

00 HTM 05 AP 001
WASTE WATER PUMP A
Pump Capacity : 80 m³/hr.
Pump Head : 30 mH

B240-00431
TO FILTRATE WATER TANK
00 HTM 03 BB 001

B270-10431 / 9587-001-109-PVM-F-001
PROCESS WATER

ASH SLURRY SYSTEM
NTPC TERMINAL POINT

S NO	SECTION	FLOW m3/hr	TEMP (°C)	DENSITY kg/m³
1	Gyp slurry from sec hydrocyclone	55.0	59.5	1024
2	Gyp slurry to WW pump Suction	80.0	59.5	1024
3	Gyp slurry from WW pump discharge	80.0	59.5	1024
4	Gyp slurry to flitrate water tank	35.5	59.5	1024
5	Gyp slurry to ISG TP Ash sump	19.5	59.5	1024
6	Waste Water Tank Recirculation	25.1	59.5	1024
7	Process water line for flushing	0.6	45.0	990

NOTE:- SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या/JOB NO. 1555 & 1556
स्थिति/STATUS CONTRACT
मुद्रण स्केल मीटर में/PRINT SCALE IN METRE 0 2 4 6 8 10 20 30 40 50

ग्राहक ड्राइंग संख्या/CUSTOMER DRAWING NO. 9587-001-109-PVM-F-020
ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना/PROJECT LARA SUPER THERMAL POWER PROJECT STAGE-II 2X800MW
भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
BOILER AUXILIARIES PLANT
RANIPET (T.N.)

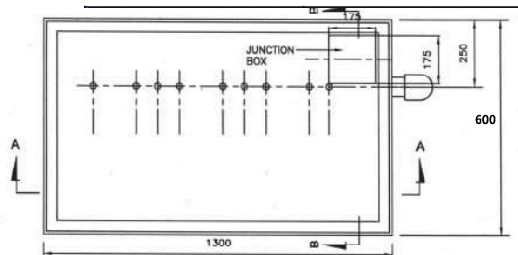
DEPT CODE		नाम/NAME	हस्ताक्षर/SIGNATURE	दिनांक/DATE
-	तैयारकर्ता/DRN	KMK	-SD-	23-02-24
	डिजाइनकर्ता/DESN	KMK	-SD-	23-02-24
	जांचकर्ता/CHD	OS	-SD-	23-02-24
	अनुमोदनकर्ता/APPD	ACR	-SD-	23-02-24

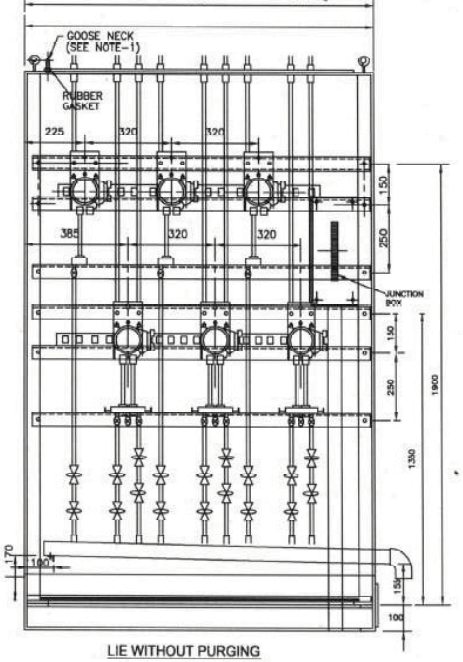
शीर्षक/TITLE
PROCESS P&I DIAGRAM
WASTE WATER TANK

विभाग/DEPT. — स्केल/SCALE –
ड्राइंग संख्या / DRAWING NO. 9587-001-109-PVM-F-020
File No. B240-00451
शीट/SHEET 12 OF 12
पुनरीक्षण/REV. 0

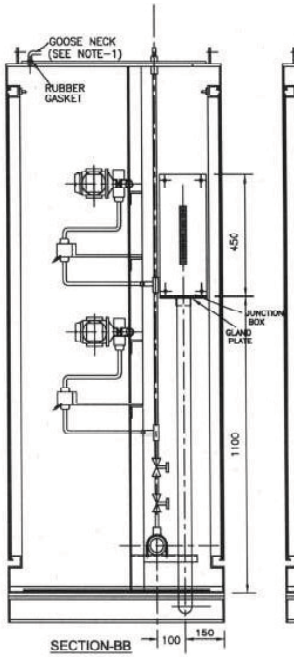
फॉर्मेट साइज A3
FORMAT SIZE A3

Page 62 of 108

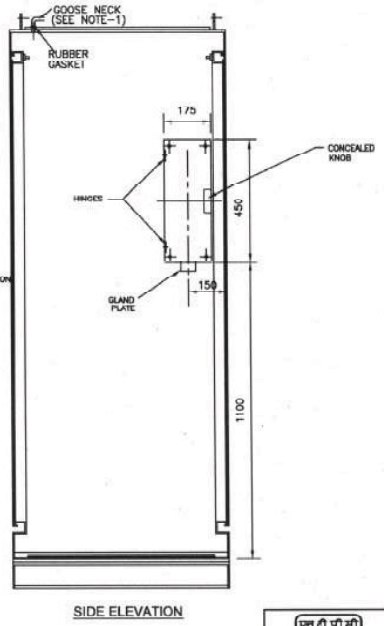




LIE WITHOUT PURGING



SECTION-BB



SIDE ELEVATION

NOTES:-

1. TO BE PROVIDED FOR LIEs USED IN STEAM & WATER APPLICATION.
2. MATERIAL OF JBs FOR LIEs SHALL BE SAME AS THAT OF LIE.

FOR TENDER PURPOSE ONLY

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE						T.G.				31.08.13

CLEARED BY

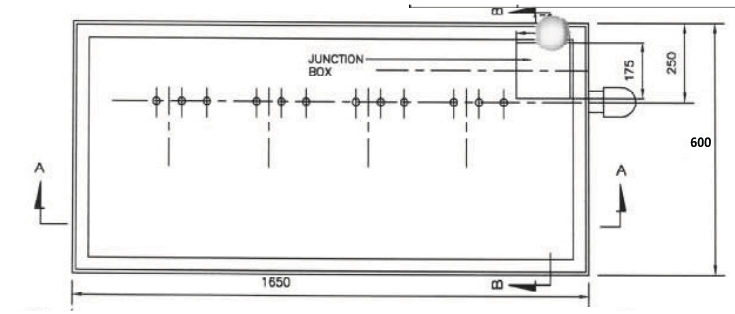
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

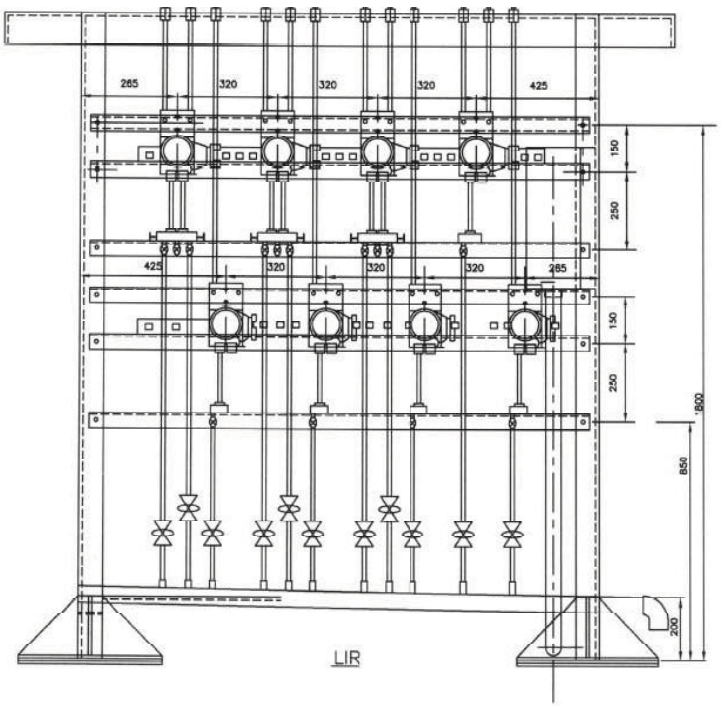
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

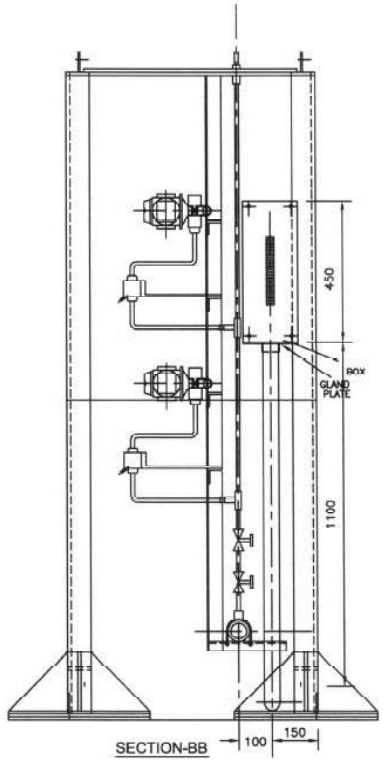
SIZE	SCALE	DRG. NO.	REV. NO.
A2	N.T.S.	0000-999-POI-A-064	B

SHEET 01 OF 03





LIR



SECTION-BB

NOTE:-

1. MATERIAL OF JBs FOR LIRs SHALL BE SAME AS THAT OF LIR.

SECTION-AA
LIR WITHOUT PURGING

FOR TENDER PURPOSE ONLY

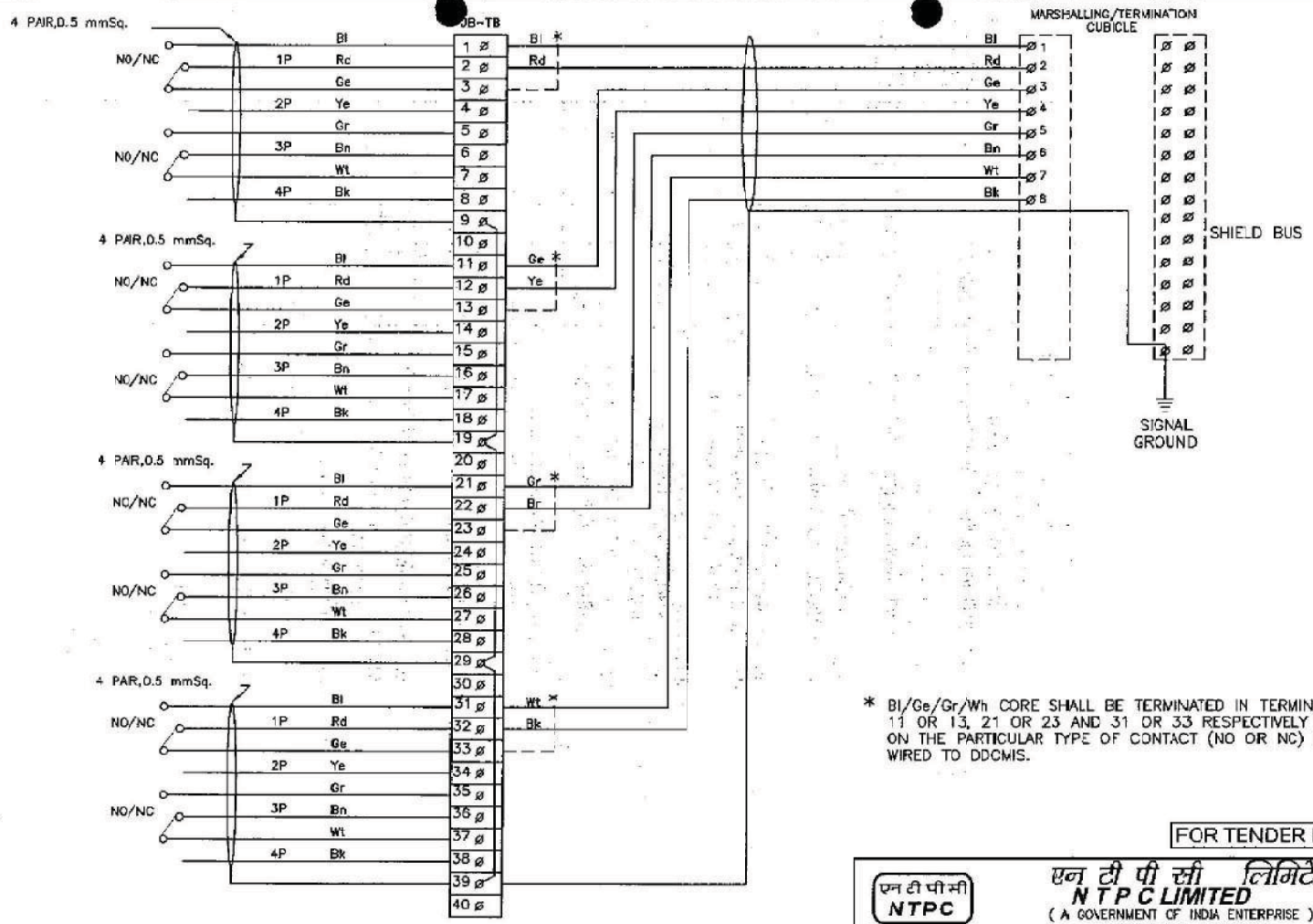
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	Cdd	ARCH.	APPD	DATE
A	FIRST ISSUE						T.G.				21.08.12

CLEARED BY

PROJECT	TYPICAL THERMAL POWER PROJECT
TITLE	TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-064 SH- 03 OF 03	A



* Bl/Ge/Gr/Wh CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DDCMIS.

FOR TENDER PURPOSE ONLY

एन टी पी सी लिमिटेड
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

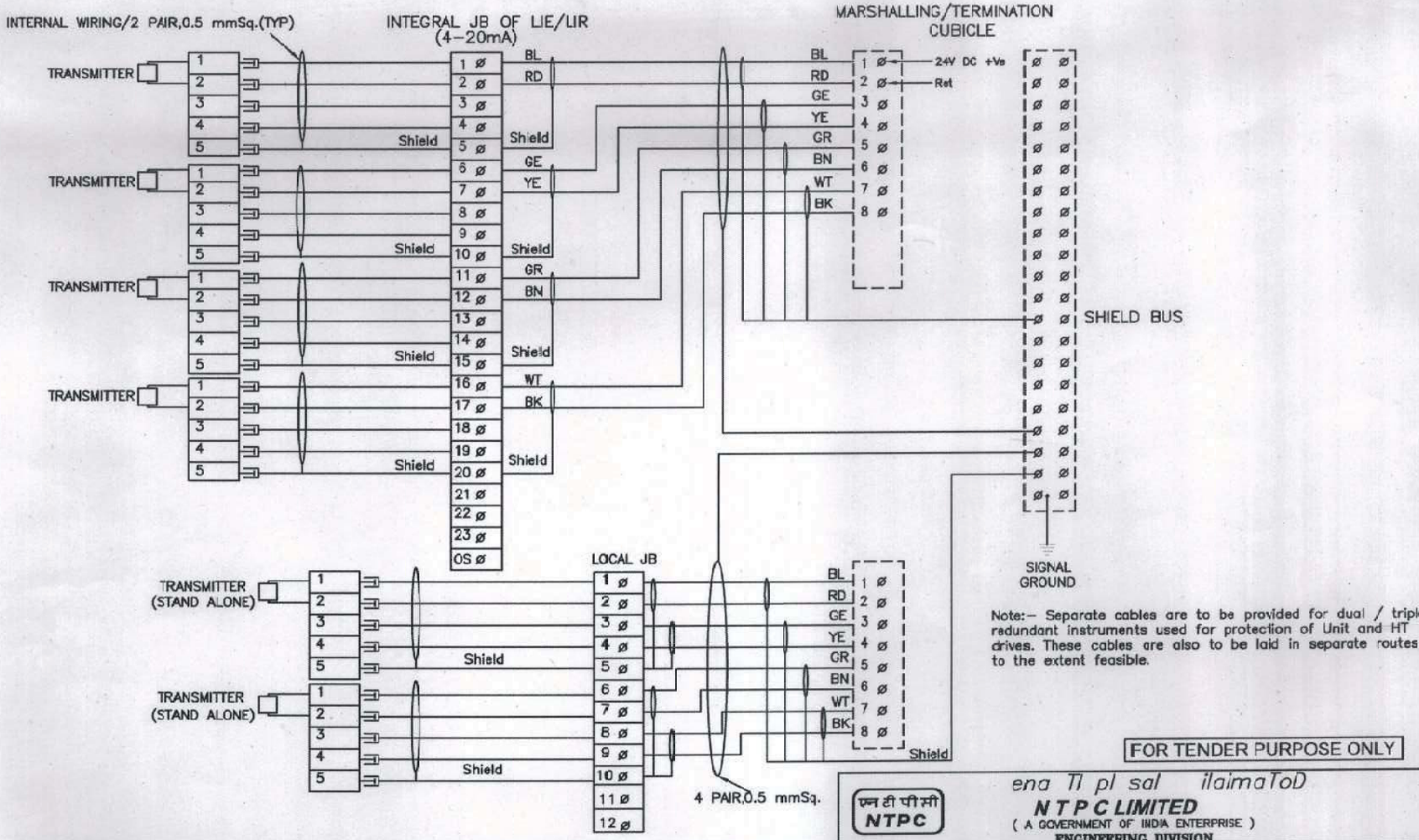
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
SWITCH TERMINATION DETAILS
NO/NC

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S	0000-999-POI-A-065 SH 02 OF 14	A



Note:- Separate cables are to be provided for dual / triple redundant instruments used for protection of Unit and HT drives. These cables are also to be laid in separate routes to the extent feasible.

FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC

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NTPC LIMITED
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ENGINEERING DIVISION

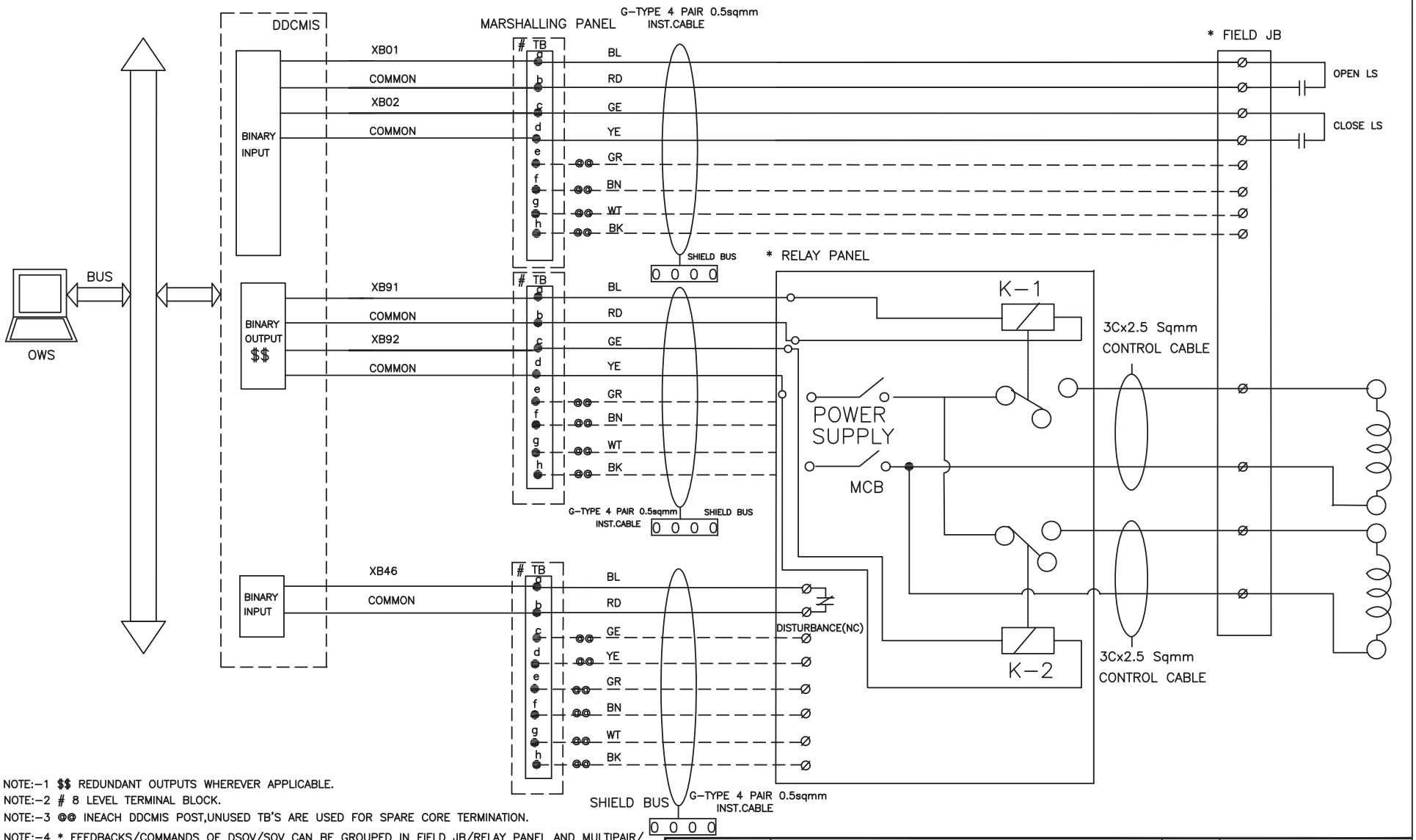
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
C	NOTE REGARDING CABLE IS ADDED.										10.12.13
B	INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN										10.12.06
A	FIRST ISSUE										12.1.05
					CLEARED BY						

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS 4-20mA

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 04 OF 14	C

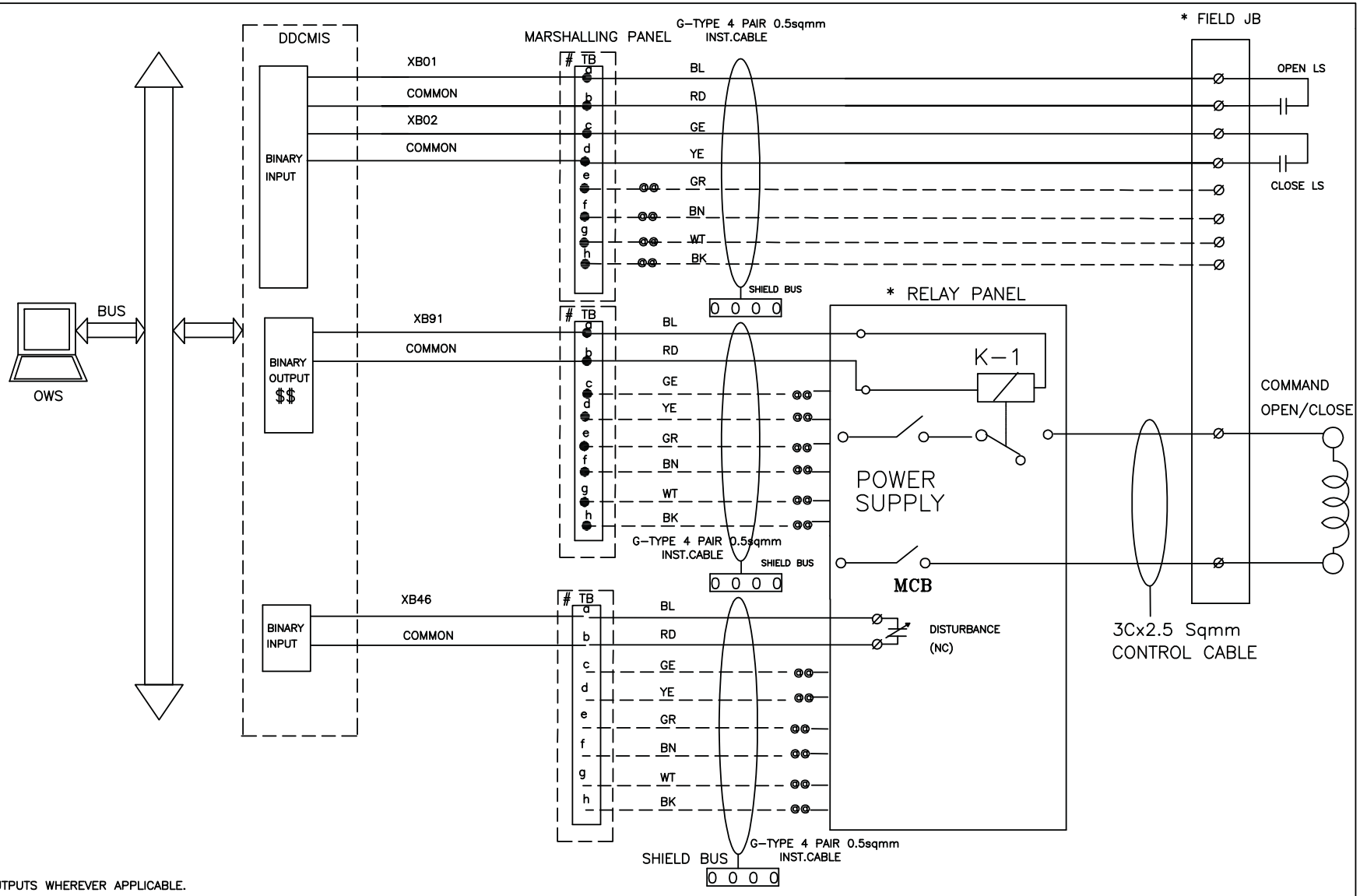
DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)



NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.
NOTE:-2 # 8 LEVEL TERMINAL BLOCK.
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/ MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHALING PANEL.
NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.
NOTE:-6 TWO INDEPENDENT OUTPUT FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES,WITH DUAL COIL SOLENOIDS.

BHEL	2x800 MW LARA STPP STAGE-II	DRG.NO.	9587-001-405-PVI-B-152B
	DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)	SHT	10 OF 30

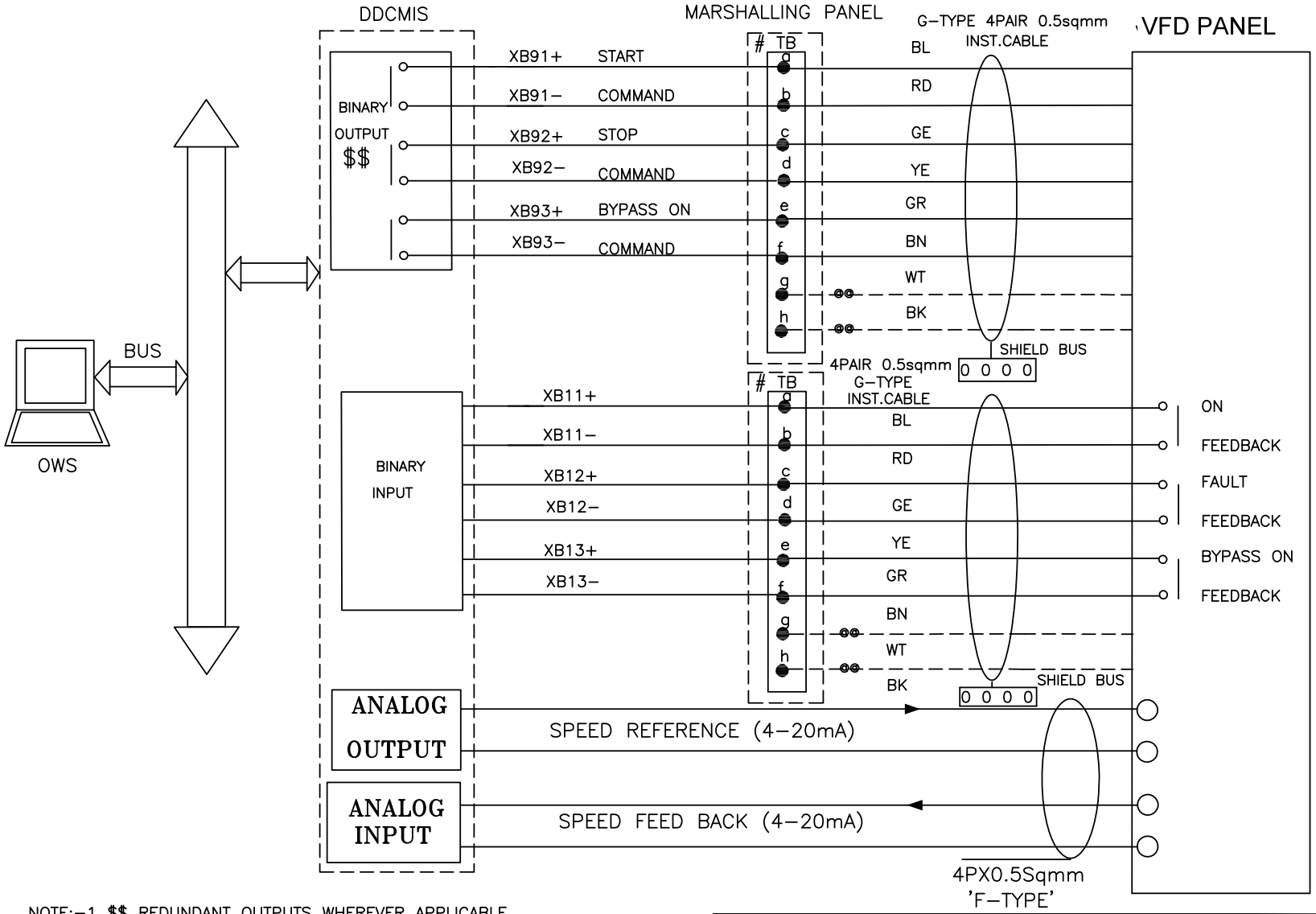
DDCMIS INTERFACE WITH SOV/O/L(WITH FEED BACKS)



NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.
NOTE:-2 # 8 LEVEL TERMINAL BLOCK.
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/ MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHALING PANEL.
NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.

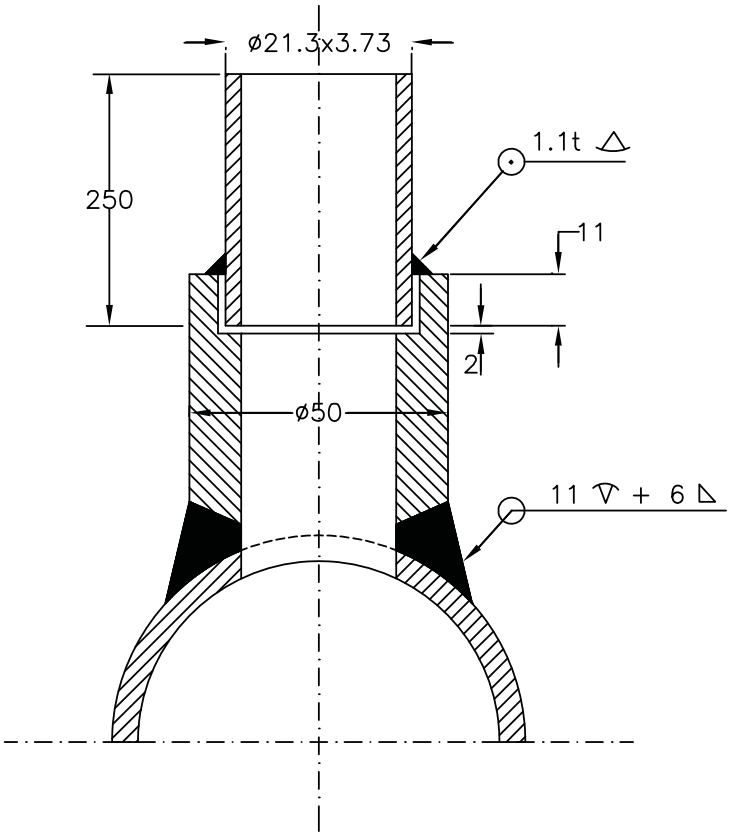
BHEL	2X660 MW NTPC TALCHER STPP	DRG.NO.	4540-001-405-PVI-W-152B
	DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)	SHT	12 OF 30

DDCMIS INTERFACE WITH VFD



NOTE:–1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:–2 # 8 LEVEL TERMINAL BLOCK
NOTE:–3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:–4 OTHER VFD SIGNALS WILL BE CONSIDERED AS PER IO LIST.

BHEL	2X660 MW NTPC TALCHER STPP	DRG.NO.	4540–001–405–PVI–W–152B
	DDCMIS INTERFACE WITH VFD OF AC SYSTEM(VFD–AC)	SHT	13 OF 30



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. STUB LENGTH SHALL BE 64mm UPTO 250Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.

TITLE :

INSTRUMENT STUB DETAILS FOR PRESSURE MEASUREMENT

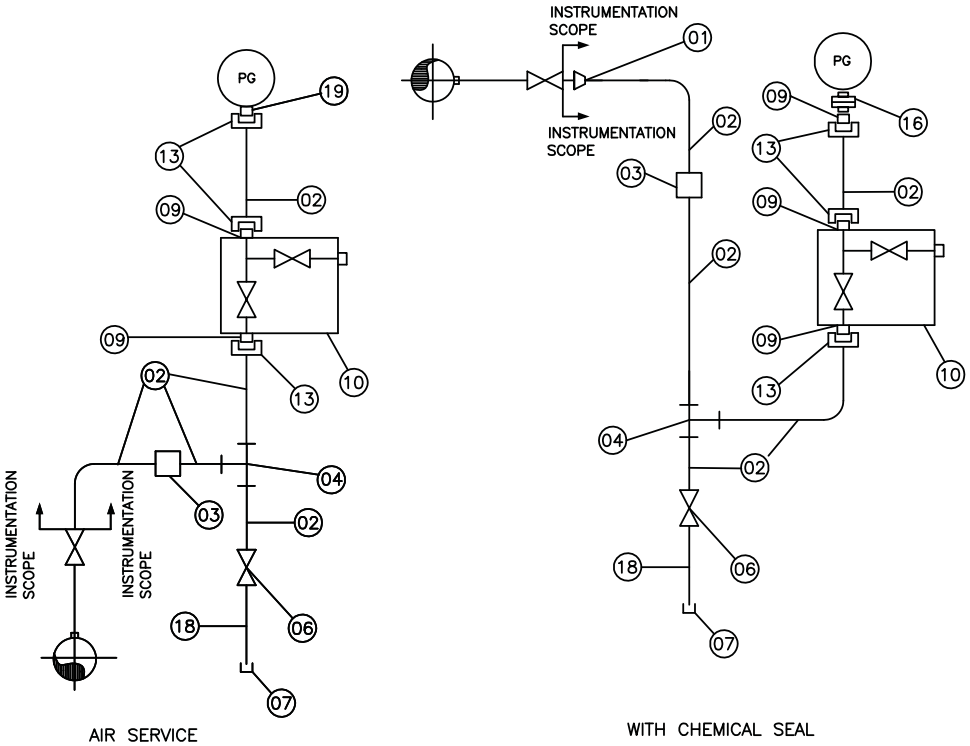
(SYSTEM PRESS UPTO 40Kg/Cm2, TEMP< 400 Deg C AND CLASS 3000#)

DRG. NO.

PE-DG-497-145-I101

REV. 00

SH. 04 OF 08 SHS.



AIR SERVICE

WITH CHEMICAL SEAL

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY				
				WATER	STEAM	PULSATING	AIR	CHEMICAL
01	REDUCER (IF APPLICABLE)	SAME AS MAIN PIPE	1" X 1/2"SW	01	01	01	00	01
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R	A/R	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R	A/R	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
06	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
07	CAP	SAME AS MAIN PIPE	1/2" NPTF	01	01	01	01	01
09	ADAPTER – M TO M	SS316	M20X1.5M X 1/2" NPTM	02	02	02	02	03
10	TWO VALVE 3 WAY MANIFOLD WITH VENT PLUG	SS316	1/2" NPTF	01	01	01	01	01
11	SYPHON	SS316	1/2" SW	00	01	00	00	00
12	SNUBBER	SS316	M20X1.5M X M20X1.5F	00	00	01	00	00
13	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	03	03	03	03	03
16	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00	00	00	01
18	NIPPLE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	01	01	01	01	01
19	ADAPTER – M TO F	SS316	M20X1.5M X 1/2" NPTF	01	01	01	01	00

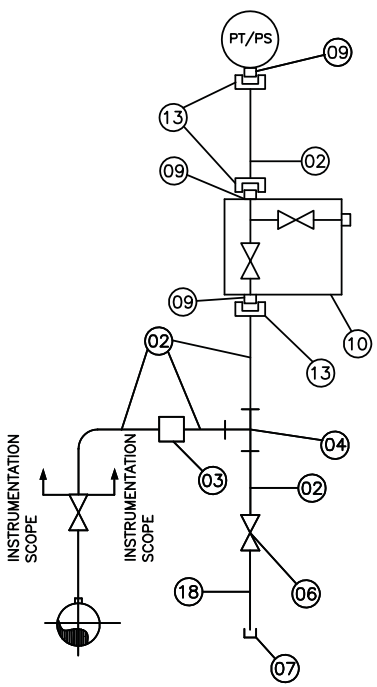
BHEL

TITLE :-

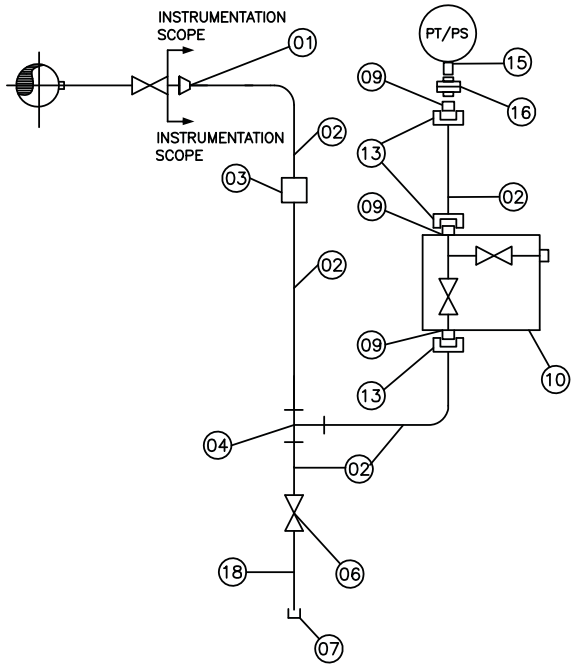
INSTRUMENT INSTALLATION DIAGRAM

PRESSURE GAUGES

DRG. NO.	PE-DG-999-145-IXXX		
REV. NO.	00	DATE	05.11.13
SHT	4 OF 9		



AIR SERVICE



WITH CHEMICAL SEAL

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY				
				WATER	STEAM	PULSATING	AIR	CHEMICAL
01	REDUCER (IF APPLICABLE)	SAME AS MAIN PIPE	1" X 1/2"SW	01	01	01	00	01
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R	A/R	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R	A/R	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
06	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01	01
07	CAP	SAME AS MAIN PIPE	1/2" NPTF	01	01	01	01	01
09	ADAPTOR – M TO M	SS316	M20X1.5M X 1/2" NPTM	03	03	03	03	03
10	TWO VALVE 3 WAY MANIFOLD WITH VENT PLUG	SS316	1/2" NPTF	01	01	01	01	01
11	SYPHON	CS	1/2" SW	00	01	00	00	00
12	SNUBBER	SS316	M20X1.5M X M20X1.5F	00	00	01	00	00
15	CONNECTOR – M TO M	SS316	1/2" NPTM X 1/2" NPTM	00	00	00	00	01
16	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00	00	00	01
13	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	03	03	03	03	03
18	NIPPLE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	01	01	01	01	01

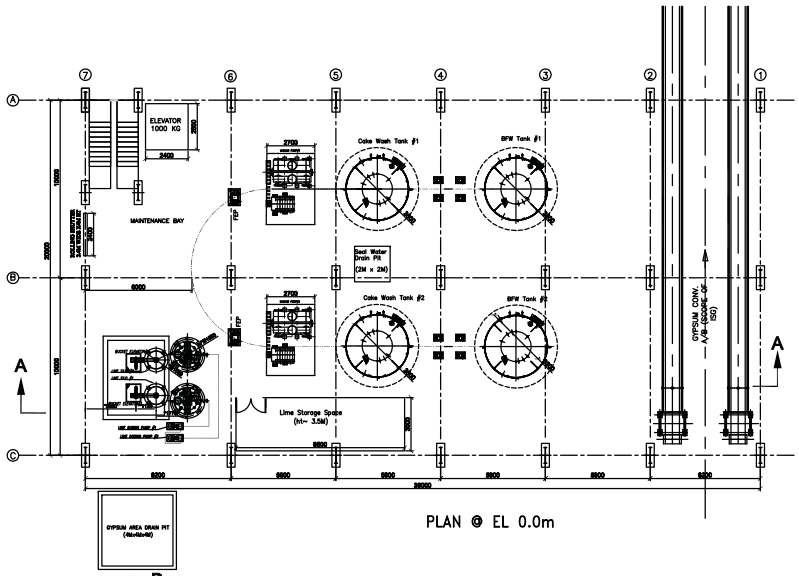
BHEL

TITLE :–

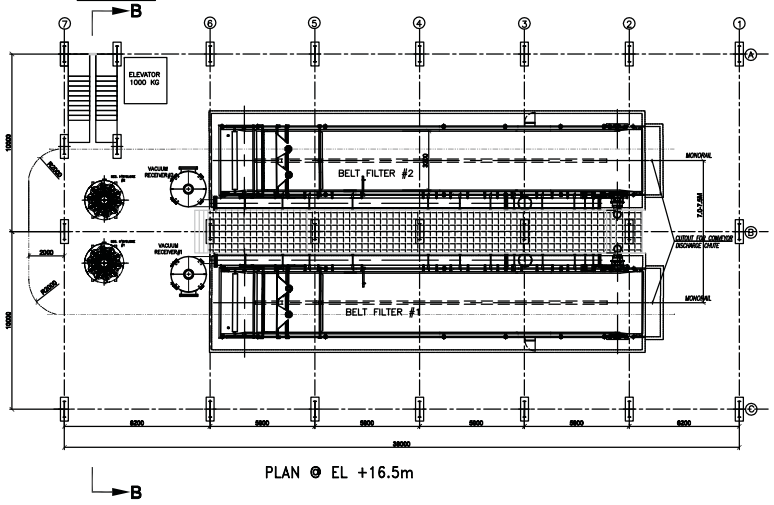
INSTRUMENT INSTALLATION DIAGRAM

PRESSURE SWITCHES/TRANSMITTERS

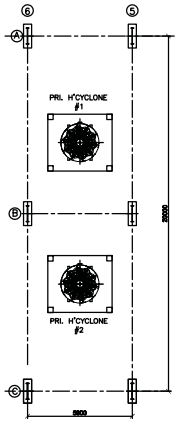
DRG. NO.	PE–DG–999–145–IXXX		
REV. NO.	00	DATE	05.11.13
SHT	6 OF 9		



PLAN @ EL 0.0m



PLAN @ EL +16.5m



PLAN @ EL +24.5M

TABLE OF EQUIPMENTS

SHEET NO	QTY.	DESCRIPTIONS	APPX WEIGHT OF EACH EQPT UNDER OPERATION	LOCATION IN GDW BUILDING	REMARKS.
1	02	VACUUM BELT FILTER	60 MT	ON FIRST FLOOR EL(+)16.5M	THE EQUIPMENT COLUMNS WILL BE SUPPORTED ON THE FLOOR
2	02	SECONDARY HYDRO CYCLONE – (SET)	8 MT (INCLUDING SUPPORTING PLATFORMS)	ON FIRST FLOOR EL(+)16.5M	THE EQUIPMENT HAS 4 COLUMNS WHICH WILL BE SUPPORTED ON THE FLOOR
3	02	NEUTRALISATION (LIME DOSING) TANK WITH AGITATOR	7 T	GROUND FLOOR @ EL(+)0.0M	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
4	02	LIME FEED SCREW CONVEYER	2 T	ABOVE NEUTRALISATION (LIME DOSING) TANK	THE SCREW CONVEYER WILL BE MOUNTED BELOW LIME SILO/HOPPER
5	02	LIME DOSING SILO/HOPPER, MANUAL GATE, MOTORISED GATE, ROTARY FEEDER & SUPPORT STRUCTURE	15 MT (COMBINED WEIGHT INCLUDING SUPPORTS)	ABOVE NEUTRALISATION (LIME DOSING) TANK	LIME SILO WILL BE SUPPORTED ON PLATFORM ON SUPPORTING STRUCTURE
6	02	PRIMARY HYDROCYCLONE	12MT (INCLUDING SUPPORTING PLATFORMS)	ON SECOND FLOOR EL(+)24.5M	PRIMARY HYDRO CYCLONE WILL BE SUITABLY SUPPORTED ON FLOOR
7	02	VACUUM PUMP & MOTOR	20 T	GROUND FLOOR @ EL(+)0.0M	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
8	02	VACUUM RECEIVER	8T	ON FIRST FLOOR EL(+)16.5M	FLOOR MOUNTED
9	02	CAKE WASH TANK		GROUND FLOOR @ EL(+)0.0M	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
10	02	BELT FILTER(CLOTH) TANK		GROUND FLOOR @ EL(+)0.0M	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
11	02	BUCKET ELEVATOR ASSY. (WITH RUBBER HOPPER & VIBRATING FEEDER) FOR LIME FEED	10T	FROM GROUND FLOOR TO LIME STORAGE SILO TOP	THE BUCKET ELEVATOR IS MOUNTED ON PIT FLOOR AND WILL REACH TO LIME SILO TOP THROUGH SUPPORT STRUCTURE.
12	02	BAG FILTER WITH BLOWERS	1.5T	ON LIME STORAGE SILO PLATFORM	BAG FILTER WILL BE SUPPORTED ON LIME SILO / PLATFORM WHICH WILL BE SUPPORTED ON FLOOR
13	02	LIME DOSING PUMPS	0.2T	GROUND FLOOR @ EL(+) 0.0M	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
14	02	FILTRATE EXTRACTION PUMPS & MOTORS	3 T	GROUND FLOOR @ EL(+) 0.0M	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
15	02	CAKE WASH PUMPS & MOTORS	0.5 T	GROUND FLOOR @ EL(+) 0.0M	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
16	02	BELT/CLOTH WASH PUMPS & MOTORS	0.3 T	GROUND FLOOR @ EL(+) 0.0M	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
17	–	PLATFORMS FOR VBF & HYDROCYCLONES	15 T	AS SHOWN	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN

Notes:

1. All Dimensions are in millimeters and elevations in meters.
2. The equipment machinery sizes and handling details shown in the drawing is indicative only
3. Floor openings,pipe crossings shall be confirmed during detail engineering.
4. Details of staircase,suitable doors,windows,ventilators shall be considered by civil designer for GDWB.
5. Elevations of floor as per communication with ISG.

FOR TENDER PRUPOSE ONLY

DETAIL OF DISCHARGE CHUTE AND GYPSUM CONVEYOR ARE INDICATIVE (IN ISG SCOPE)

NTPC — National Thermal Power Corporation Ltd. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: 2X800 MW LARA STAGE-II

Bharat Heavy Electricals Ltd, PEM NOIDA 201301

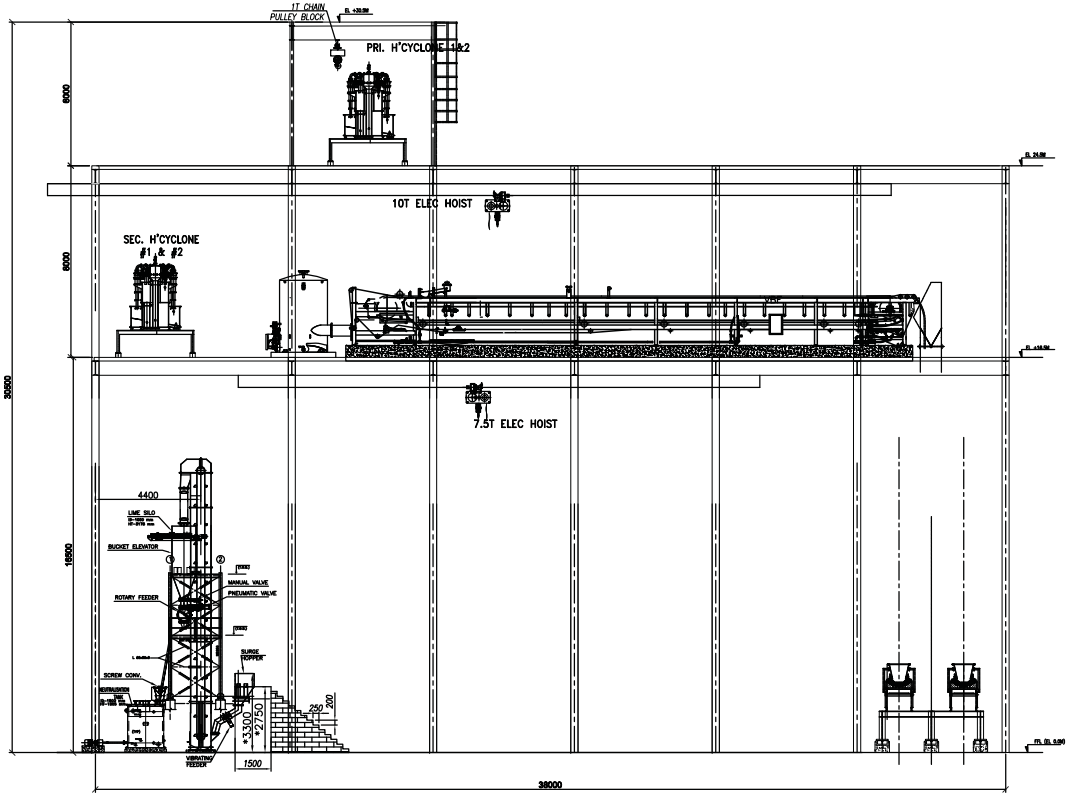
	NAME	SIGNATURE	DATE
DRN	SA		30.01.23
CHD	RR		30.01.23
APPD	RR		30.01.23

DEPT: — | DRWG NO: — | SCALE: NTS | WEIGHT (Kg): — / **** | NOT TO SCALE / SCALE 1000 | REV NO: — | NO. OF SHEETS: —

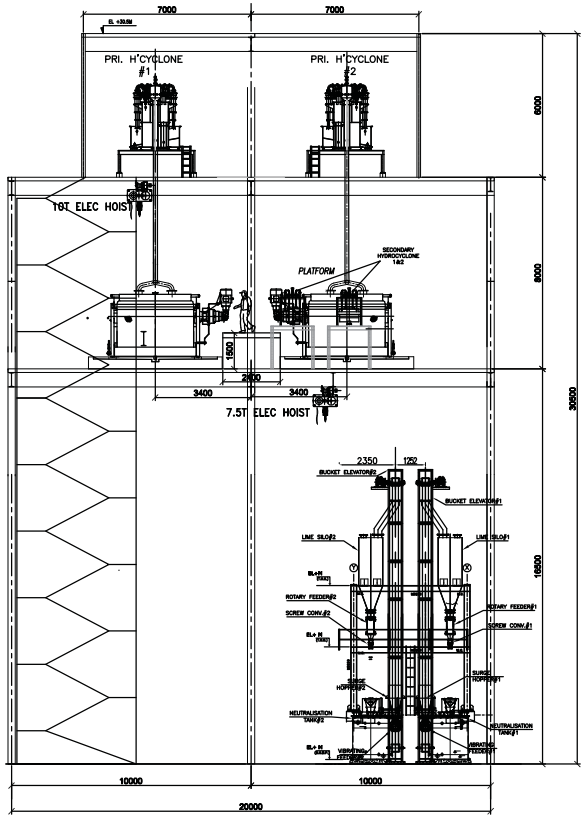
TITLE: GA of GDWS Sh 01 of 02 | CODE: — | DRAWING NO: — | REV: 0A

Rev	Date	Drawn	Checked	Approved	Remarks

Size A0



SECTION – AA



SECTION – BB

FOR TENDER PRUPOSE ONLY

DETAIL OF DISCHARGE CHUTE AND GYPSUM CONVEYOR ARE INDICATIVE (IN ISG SCOPE)

Rev	Date	Drawn	Checked	Approved	Remarks

NTPC — National Thermal Power Corporation Ltd. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: 2X800 MW LARA STAGE-II

Bharat Heavy Electricals Ltd, PSM NOIDA 201301

DRN	SA		30.01.23
CHD	RKS		30.01.23
APPD	RKS		30.01.23

SCALE: NTS | WEIGHT (Kg): ---- | SIZE: A1

TITLE: GA of GDWS Sh 02 of 02

DRAWING NO : CWD CODE U 01

REV: 0A

Size A0

PERFORMANCE GUARANTEES TO BE DEMOSTRATED AT SITE

1. Performance Guarantee to be demostrate at site in line with ASME PTC 40 code

2 Sucessuful bidder shall submit the Performance Guarantee test procedure for approval of BHEL / Customer.

1.3 Process Parameters For Vacuum Belt Filter

Sl. No.	Parameters	Unit	Belt Filter Feed Slurry	Product Gypsum	Belt Wash Water ($)	Cake Wash Water ($)
a.	Total Flow	m^3/hr.	64.42*		16.0	16.0
b.	Total Flow	t/hr. - Wet	87.57*	43.54	15.9	15.9
c.	Operating Temp	°C	59.5		45	PEM to Provide
d.	Design Temp	°C	70		55	
e.	Solid (% wt.)	%	**45#**	**>90#**		
f.	Density	kg/m^3	1359*		990	
g.	pH		4-7	5-8	7.6-8.5	
h.	Chloride Cl^-	mg/l	<25000	**<100 ppm#**	<215	
i.	Belt filter and the peripherals design capacity = **47.9 t/hr. (wet cake)**					
j.	Number of Vacuum belt filters : 2 numbers (1 W + 1 S)					

Note:

- Process water Analysis (used for belt & cloth washing) is given in section 2.0.
- Clarified water Analysis (used for cake washing) shall be furnished by PEM to vendor.
- $ Quantity of Belt wash & Cake wash water specified to be fulfilled by the vendor. Belt filter wash tank & Cake wash tank sizing (Refer Tanks input transmittal) is arrived based on the same. PEM to ensure.
- Clarified water quantity shall be fulfilled by vendor and PEM to ensure the availability of the same.
- * shall be finalized by vendor.
- # shall be guaranteed by vendor.

QUALITY PLAN (MECHANICAL)

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT RECORD		AGENCY			Remarks
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N				D	M	C	N	
1.0 RAW MATERIAL (*Material shall be as per Drawing)														
1.1	Vacuum pump	Physical & Chemical for impeller, casing, shaft.	MA	Physical	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	Ö	P	V	V	NOTE-5
		NDT of Impeller, casing, shaft, sleeve	MA	DPT	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	V	V	NOTE-5
		Balancing of Rotating Parts	MA	Static & Dynamic Balancing	100%	100%	ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	IR	Ö	P	V	V	NOTE-5
		NDT of Impeller & Shaft	MA	UT	100%	100%	ASTM A 388/ASME Sec.V	ASTM A 388/ASME Sec.V	IR	Ö	P	V	V	UT of shaft ≥ϕ 40mm NOTE-5
1.2	Speed reducer	Visual, dimensional, Run test including oil leakage, Temp. rise, Noise level and vibration	MA	Visual	100%	100%	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	IR	Ö	P	V	V	
1.6	Water Pump/ Slurry Pump	Chem. & Mech. Properties of Impeller, Casting, Shaft, Lining*	MA	Chemical Mechanical	100%	100%	Approved Drawing/Data sheet/Relevant Standard	Approved Drawing/Data sheet/Relevant Standard	TC	Ö	P	V	V	UT of shaft ≥ϕ 40mm *Lining if applicable
		Balancing of Rotating Parts	MA	Static & Dynamic Balancing	100%	100%	ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	IR	Ö	P	V	V	
		Hydro test of casing	MA	Static pressure testing	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	V	V	Hydrostatic testing of casings for 30 min. at 1.5 times of shut-off head or 2 times pump rated head which ever higher.
		NDT of Impeller, casing, shaft, sleeve	MA	DPT	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	V	V	
		NDT of Impeller & Shaft	MA	UT	100%	100%	ASTM A 388/ASME sec.V	ASTM A 388/ASME sec.V	IR	Ö	P	V	V	UT of shaft ≥ϕ 40mm

QUALITY PLAN (MECHANICAL)

1.7	Hydro cyclone	Visual & Dimension	MA	Visual & Measurement	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	W	V	NOTE-5
1.8	Valves (Control valve & Butterfly Valve etc*)	Material certificate Hydrostatic test Seat leak test Function test Dimensions	MA	Visual	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	V	V	*As applicable NOTE-5
1.9(a)	Rubber Composition	Material content	MA	Chemical	1/Batch	1/Batch	Approved Drawing/Data sheet	Approved Drawing/Data sheet	COC	Ö	P	V	V	
1.9(b)	Rubber lining	Spark test at accessible area	MA	Inspection check	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	W	V	Spark test 10-12.5KV min.
1.1	LT Motor	Make, Rating, Type, Routine Test, Paint	MA	Visual	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	V	V	For Motor up to 30KW COC Will be submitted. NOTE-5
1.11	Junction Box	Type Test- Enclosure Protection Test	MA	Visual	One of Design	One of Design	IS:60529	IS:60529	IR	Ö	P	V	V	NOTE-5
1.12	(Transmitters, Switches, Gauges, RTD etc.)	COC/Functional Check	MA	Visual	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	Ö	P	V	V	
2	**FINAL INSPECTION(Vacuum belt filter assembly)**													
2.1	Vacuum belt filter assembly	Dimensional	MA	Dimensional	100%	100%	Approved Drawing	Approved Drawing	IR	Ö	P	W	W	
		Run test(for 30 minutes)	MA	Visual, Measurement	100%	100%	Approved Drawing	Approved Drawing	IR	Ö	P	W	W	
2.2	All components required paints.	Paint Finish, Paint Thickness, High voltage porosity test	MA	Measurement	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	W	V	
2.3	Vacuum pump/ Water Pump/ Slurry Pump	Capacity, power, pressure, efficiency, noise, vibration, temperature rise	MA	Measurement	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	Ö	P	W	V	NOTE-5
3	**VACCUM TANK (RAW MATRIAL INSPECTION)**													
3.1	Plates for shell and dished ends & structural	Chemical & Physical	MA	Chemical & Physical	1/Heat	1/Heat	Approved Data Sheet /Drawing	Approved Data Sheet /Drawing	TC	Ö	P	V	V	
4	**IN PROCESS CONTROLS**													
4.1	Welding (As applicable)	WPS,PQR,WPQ	CR	Visual	100%	100%	ASME Sec, IX/Relevant Standard	ASME Sec, IX/Relevant Standard	Report	Ö	P	V	V	

QUALITY PLAN (MECHANICAL)

4.2	Stress Relieving	Physical	MA	Physical	100%	100%	Relevant Standard/Manufacturer standard	Relevant Standard/Manufacturer standard	HT chart	Ö	P	V	V	As applicable
4.3	All Weld	Weld Quality	MA	DPT	100%/10 %	100%/10 %	Relevant Standard /ASME Sec –VIII Div.1	Relevant Standard /ASME Sec –VIII Div.1	IR	Ö	P	W	V	100% DPT on root run of butt weld, nozzle welds and finished fillet welds
4.4	Weld quality of circumferential & longitudinal seams	Weld Defect	CR	RT- Review of documents	100%/10 %	100%/10 %	Relevant Standard /ASME Sec –VIII Div.1	Relevant Standard /ASME Sec –VIII Div.1	IR	Ö	P	V	V	Butt welds of dished ends shall be stress relieved and subjected to 100% RT. 10% RT (covering all 'T'/cross joints) of butt welds.
5	**FINAL INSPECTION (Complete System)**													
5.1	Complete System	Dimensional	MA	Dimension	100%	100%			Approved Drawing	Ö	P	W	V	NOTE-5
		Nozzle Orientation	CR	Dimension	100%	100%	Approved Drawing	Approved Drawing	IR	Ö	P	W	V	NOTE-5
		Hydro Test	CR	Hydro Test	100%	100%	2X working PR or 1.5x design PR Whichever is higher for 30 minutes	2X working PR or 1.5x design PR Whichever is higher for 30 minutes	IR	Ö	P	W	V	NOTE-5
		Pneumatic Test of RF pads for soundness /leakages	CR	Pneumatic Test	100%	100%	ASME SEC –VIII /appd. Drg/appd. Datasheet	ASME SEC –VIII /appd. Drg/appd. Datasheet	IR	Ö	P	W	V	*as applicable NOTE-5
5.2(a)	Rubber Lining of tank	Spark test	MA	Electrical	100%	100%	Technical Spec/ Relevant standard	Technical Spec/ Relevant standard	IR	Ö	P	V	V	Spark test 10-12.5KV min.
5.2(b)	Rubber Lining of tank	Hardness testing	MA	Physical	100%	100%	Technical Spec/ Relevant standard	Technical Spec/ Relevant standard	IR	Ö	P	W	V	Shore hardness value shall be within 60. NOTE-5
5.3	Junction Box	Insulation Resistance Test High Voltage Test	MA	Electrical	100%	10%	Approved Drawing	Approved Drawing	IR	Ö	P	W	V	NOTE-5
5.4	Painting & Marking	Paint Finish, Thickness, HV porosity test	MA	Visual	100%	100%	Appd. Drg /Data Sheet	Appd. Drg /Data Sheet	IR	Ö	P	V	V	NOTE-5
5.5	Packing	Proper Packing	MA	Visual	100%	100%	Technical Spec	Technical Spec	Packing List	Ö	P	V	V	NOTE-2,5

QUALITY PLAN (MECHANICAL)

5.6	Quality Dossier	Document	MA	Visual	100%	100%	Compilation of documents	Compilation of documents	Quality Dossier	Ö	P	V	V	

Legends:
*Records, Identified With "Tick"(√) Shall Be Essentially Included By Supplier In QA Documentation,
** M: Supplier/ Manufacturer/ Sub-Supplier, C: Main Supplier/ Bhel/ Third Party Inspection Agency, N: Customer,
P: Perform, W: Witness, V: Verification, As Appropriate
MA: Major, MI: Minor, CR: Critical
IR: Internal Report D: Documentation
RT: Radiography Test UT: Ultrasonic Test DPT: Die Penetrant Test

Note:
1. Original TCS / Photocopies Certified In Original By Mill Shall Be Furnished For Review.
2. Packing Photo Graph Is To Be Submitted To BHEL Before Dispatch.
3. Bhel Reserves The Right For Conducting Repeat Test, If Required.
4. During Testing Only Calibrated Measuring And Testing Instrument Is To Be Used And. Calibration Certificates Are Needed To Be Furnished During Inspection.
5. These Tests/Checks Are Indicative Only. Further Tests May Be Added Based On End Customer Requirement And Will Be Finalised During Detailed Engineering

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 50 KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	C/ N					M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 50 KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:
1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR**, CR:** CRITICAL
D: DOCUMENTATION

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-1/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y		Y	Y			Y					Y							
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										
Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y												

Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y															
Complete Motor	Y	Y	Y											Y	Y	Y	Y1	Y

Note:

1. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, following methodology to be followed for Inspection Categorization:

Note for LT Motor:

i) Motor rating up to 50 KW: Inspection CAT- III : Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main Contractor confirming as follows:
"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot s
KVA/KW, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets."

ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC rev
report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main Contractor confirming as follows:
"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot s
KVA/KW, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets."

iii) Motor rating 75 KW & above: Inspection CAT-I: As per NTPC approved MQP.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.
4. Y1 = for HT Motor / Machines only.
5. For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission, the motor shall be subjected to efficiency test.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

ANNEXURE-III

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE		NAME		DATA FILLED UP ON	
	SYSTEM		SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

CABLE ID	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/VENDOR)	REMARKS	CABLE SIZE	PATH CABLE NO

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: GYPSUM DEWATERING SYSTEM

SCOPE OF VENDOR: SUPPLY & SUPERVISION OF VENDOR'S EQUIPMENT

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	11 kV / 3.3 KV / 415 V Switchgear	BHEL	BHEL	HT motor, (Motor feeder) power supply shall be provided by BHEL For all LT motor & Auxiliary supply, 415 V AC (3 ph. 4 wire)/240 V AC (supply feeder) shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL BHEL BHEL	 BHEL BHEL BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	BHEL	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC etc.	Vendor	BHEL	
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL BHEL	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	a. Cable glands b. Lugs and bimetallic strip for equipment supplied by Vendor	Vendor Vendor	BHEL BHEL	a. Double compression Ni-Cr plated brass cable glands b. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: GYPSUM DEWATERING SYSTEM

SCOPE OF VENDOR: SUPPLY & SUPERVISION OF VENDOR'S EQUIPMENT

	equipment supplied by vendor			rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware.	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
13	HT Motor with base plate and foundation hardware.	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
14	HT cable & Cable termination kit for HT Motor	BHEL	BHEL	
15	Mandatory spares	Vendor	-	Vendor to quote as per specification.
16	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
17	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
18	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
19	Electrical Equipment & cable tray layout drawings	-	-	Vendor to furnish drawing (both in print form as well as in AUTOCAD) of Gypsum Dewatering Building layout clearly indicating all motors, panels, JB's etc. which require cabling along with their terminal box/location/ Foundation etc.
20	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

QUALITY PLAN - C&I

Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

MEASURING INSTRUMENTS									
Item Components _____ _____ Sub System Assembly	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (As applicable)(R)	Hydro Test(R)	Material Test certificate (R)
Pressure Gauge (IS-3624)	Y	Y	Y	Y	Y				
Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
R-Routine Test A- Acceptance Test Y – Test applicable									

ELECTRICAL ACTUATOR													
Test/Attributes Characteristics _____ _____ITEM/COPONENT/SUB SYSTEM/ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Local/ Remote (Open-Stop-Close) Operation®	Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR with Integral Starter , Non-Intrusive Electrical Actuator (EN15714-2)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
® - Routine Test A - Acceptance Test Y - Test applicable													
Note:													

QUALITY PLAN - C&I

PROCESS CONNECTION AND PIPING

Tests / Items	Visual & Dimensions ®	GA, BOM, Layout of component & construction feature, Paint Shade/thickness ®	Flattening,flaring,hydrotest, hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydrulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
Local instruments racks	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y*		Y		Y	Y							
Impulse pipes and tubes	Y		Y			Y						Y		
Socket weld fittings ANSI B-1(	Y					Y						Y		Y
Compression fittings	Y					Y					Y	Y	Y	
Instrument valves & Valve mar	Y					Y					Y	Y		
*-applicable for painted junction boxes.														
®-Routine Test A-Acceptance Test Y – Test applicable														

LOCAL CONTROL PANEL

Tests / Items	Pre Power on Check (#) (R)	Post Power on Check (%) (R)	Internal cabling / Wiring checking(R)	Door Alignment, waviness, and Locking (R)	Louvers, Fans, wire mesh, Lifting arrangement (R)	HV / IR on wired panels (R)	Paint Shade, Thickness and Illumination (R)	Hardware/Make as per BOM (R)	Dimensions, GA, layout (R)
Local Control Panel	Y	Y	Y	Y	Y	Y	Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
Note:									
1) Pre power on check: - Wire dressing, looseness, Availability of Fuses and MCB, Modules are inserted properly, Earthing connection, Input									

QUALITY PLAN - C&I

VARIABLE FREQUENCY DRIVE

Item Components _____ _____Sub System Assembly	Electrical Properties	Mechanical Properties	Chemical Properties	Dimensions / Finish	Type/ Rating/Functional check	HV/IR	Routine test as per relevant std.	Constructional Features	IS:6005 ,Seven tank process	Paint finish/ shade/thickness	Mountings / BOM/ Make, Completeness/	Interlock Functional & Operation Testing / Simulation check	Degree of Protection Test	Final testing as per Relevant IS/IEC
Sheet Steel (IS-513)		Y	Y	Y										
Aluminum / Copper Bus-bar(IS-5082/IS-613/IS-1987)	Y	Y	Y	Y										
Support Insulator (BS-2782/IEC-660/IS-10912)	Y	Y	Y	Y										
Control / Selector Switch(IS-6875)					Y	Y	Y							
Contactor/ MCB(IS-13947)					Y	Y	Y							
O/L Protection relays(IS-3231)					Y		Y							
C.T /V.T/ Indicating Meter(IS-2705/3156/1248)					Y	Y	Y							
Fuse/ Fuse carrier(IS-13703)					Y	Y	Y							
Terminals/lugs/pvc wires(IS-13947//IS-694)	Y			Y	Y	Y	Y							
Timers(IS-3231)					Y	Y	Y							
Push Button/ Lamp/ (IS-6875)					Y	Y	Y							
Control Transformer (IS-12021)					Y	Y	Y							
Mimic, Annunciater					Y		Y							
GASKET(IS-11149)		Y	Y	Y	Y		Y							
Fabrication								Y						
Pretreatment & Painting									Y	Y				
VFD panel										Y	Y	Y	Y	Y

NOTE: 1. All major Bought Out Items will be subject to NTPC approval.

SUB VENDOR LIST

Approved sub vendor list is listed below. However, bidder is requested to submit additional vendor list after award of contract for approval of BHEL / Customer.

ITEM CODE	ITEM/SERVICE DESCRIPTION	SL NO.	VENDOR CODE	VENDOR NAME	ADDRESS	PHONE	REMARKS
ES53	LV MOTORS (NON FLAME PROOF)	1	A24	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	0129-2567580, 09871799449	
	LV MOTORS (NON FLAME PROOF)	2	E1027	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.	Tel.: + 91 (11) 25816931-33, 35 & 36| DT: +91 25724318 Fax: + 91 (11) 25819640| M:+ 91 9818 121132 www.bharatbijlee.com	
	LV MOTORS (NON FLAME PROOF)	3	C02	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA	91 11 23460700 - 999 Sunil.Das@cgglobal.com	
	LV MOTORS (NON FLAME PROOF)	4	A35	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	044-49681447	
	LV MOTORS (NON FLAME PROOF)	5	K01	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055	Tel: +91-80-23374865 Fax: +91-80-23377706	
	LV MOTORS (NON FLAME PROOF)	6	L04	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA	0217- 2357001-005	APPROVED UPTO 200KW
	LV MOTORS (NON FLAME PROOF)	7	M01	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006	Ph: +91-129-2286421, 2265340, 4006601 to 4006610	
	LV MOTORS (NON FLAME PROOF)	8	A35	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045	Ph: (011) 2539 7763	
	LV MOTORS (NON FLAME PROOF)	9	E1115	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	91-22-26730823, 26730789; 91)-(22)-26730154	
	LV MOTORS (NON FLAME PROOF)	10	S01	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	0124-2842000, 9873424331 amit.bhadauria@siemens.com	
ES12	CABLE LUGS	1	E1040	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.	
	CABLE LUGS	2	E1149	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	033 2282 2540	
ES11	CABLE GLANDS	1	E1201	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Mr. Vijay Mohan Sood +(91)-(120)-2525694 +(91)-(120)-3052594 +(91)-(11)-23287156 vijay_mohansood@yahoo.com	
	CABLE GLANDS	2	E1017	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	033 2473 0850	
	CABLE GLANDS	3	E1206	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	44-24995505,22680990-4	
	CABLE GLANDS	4	E1036	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	91-022-26852961/62/63 comet@vsnl.net	
	CABLE GLANDS	5	DW08	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.	
	CABLE GLANDS	6	E1044	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-22-28324829 / 66919034 devang@electromacglands.com	
	CABLE GLANDS	7	I01	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	91-33-2480161/62/63/64 Fax : 91-33-2485766	
	HT MOTORS (CAT-1)	1		HYOSUNG	KOREA	UPTO 11KV 13.5 MW	
	HT MOTORS (CAT-1)	2		WEG	BRAZIL	UPTO 11KV 2150 KW	
	HT MOTORS (CAT-1)	3		WEG	HOSUR	UPTO 11KV 14 MW	
	HT MOTORS (CAT-1)	4		BHEL	BHOPAL	RQP	
	HT MOTORS (CAT-1)	5		HYUNDAI	KOREA	UPTO 11KV 17 MW	
	HT MOTORS (CAT-1)	6		TECO	TAIWAN	UPTO 11KV 12 MW	
	HT MOTORS (CAT-1)	7		TMEIC	JAPAN	UPTO 11KV 14 MW	
	HT MOTORS (CAT-1)	8		CONVERTEAM	FRANCE	UPTO 11KV 18 MW (*DOCUMENTS FOR NAME	
	HT MOTORS (CAT-1)	9		ABB	VADODARA	UPTO 6.6KV 2500 KW 11KV 2000 KW FOR PUMP/ FAN/	
	HT MOTORS (CAT-1)	10		IJLIN	KOREA	UPTO 11KV 2900 KW, 6.6KV 2500 KW	
	HT MOTORS (CAT-1)	11		JYOTI	VADODARA	UPTO 6.6 KV 2250 KW EXCEPT CRUSHER & MILL	
	HT MOTORS (CAT-1)	12		MARATHON	KOLKATA	RQP, UPTO 6.6 KV 1300 KW FOR CRUSHER WITH SCOOP	
	HT MOTORS (CAT-1)	13		CGL (D5 INDUSTRIAL AREA)	MANDIDEEP	UPTO 1650 KW 6.6 KV, 1350 KW 11 KV FOR PUMP, FAN,	
	HT MOTORS (CAT-1)	14		CGL(PLOT 9)	MANDIDEEP	UPTO 11 KV 4MW FOR PUMP/FAN/COMPRESSOR	
	HT MOTORS (CAT-1)	15		CG ELECTRIC SYSTEM	HUNGARY	UPTO 3.3 KV 1100 KW	
	HT MOTORS (CAT-1)	16		TMEIC	BENGALURU	UPTO 11 KV 5000 KW	

PAINTING REQUIREMENT

(i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard.
(ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.
(iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.
(iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns.
(v) Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.
(vi) Bidder to submit the painting schedule incorporating the above point for approval of BHEL / Customer

PACKING REQUIREMENT

Sl.no	DESCRIPTION
1	**Type of Packing:**
1.1	Item shall be fully covered with multi layered cross laminated colourless polyethylene sheet of at least 100 GSM and shall be packed inside wooden box or crate or fixed on wooden pallet depending upon the size.
1.2	Item shall be firmly fixed to the bottom of the packing box/crate/pallet with the help of supports/blocks to arrest the movement from all sides. The branch pipe ends and all opening shall be protected with polyethylene blind end caps.
1.3	Loose items/accessories like nipples, expander/reducer, root valves etc. shall be separately packed with polyethylene sheet of at least 100 GSM inside the packing box/crate.
2	**Quality of wood:**
2.1	**Quality of wood:** Wood used for packing box shall be Pinewood, Rubber wood, Mango wood, Fir wood, Silver Oak wood or other as per availability with moisture content not exceeding 30%.
3	**Cushioning material and moisture absorber:**
3.1	Suitable cushioning shall be provided by rubberized coir/ thermocol / expanded soft polyethylene foam.
3.2	Adequate quantity of packed desiccant shall be suitably placed inside the packing box.
4	**Packing slip & holder:**
4.1	Packing slip kept in polyethylene bag shall be placed inside the wooden box at appropriate place.
4.2	One copy of packing slip wrapped in polyethylene bag covered in galvanized iron tin sheet/ aluminium packing slip holder shall be fixed on the external surface the packing box.
5	**PACKING AND FORWARDING**
5.1	Proper packing to be ensured for the Gypsum Dewatering Equipment & its components. Indigenous Supply: Shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the pump internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards of this sub-section. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.

PACKING REQUIREMENT

5.2	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
5.3	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
5.4	The entire equipment/ system has to be supplied in containers and it should be suitable for storing in the outer yard of the plant for a minimum period of 12 months. Crates and packing material used for shipping will become the property of owner.
5.5	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
5.6	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
5.7	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
5.8	Each package or shipping units shall be clearly marked or stenciled on at least two sides with the **DETAILED SHIPPING ADDRESS –TO BE PROVIDED LATER.** In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.

PACKING REQUIREMENT

5.9	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
5.10	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
5.11	Wherever necessary besides usual inscriptions the cases shall bear special indication such as “Top”, “Do not turn over”, “Care” , “Keep Dry” etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks).
5.12	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following:
	a. Upright position
	b. Sling position and center of Gravity position
	c. Storage category
	d. Fragile components (to be marked properly with a clear warning for safe handling)
5.13	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
6	**The packing slip shall contain the following information: -**
6.1	Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of pump & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
6.2	Prior to transport from manufacturer’s work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.

PACKING REQUIREMENT

6.3	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
6.4	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering.
	Also, complete billing break-up with above mentioned details shall be submitted to Purchaser within 10 days of placement of the LOI.
6.5	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
6.6	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.

BILL OF QUANTITY (BOQ)

SL NO.	DESCRIPTION	UNIT	Qty
1	**MAIN SUPPLY**		
1.1	Primary hydro cyclone comprising of		
(a)	Hydrocyclone clusters	SET	2
(b)	Anchor bolts, nuts and washers		
(c)	Flanges for inlet and overflow		
(d)	A variety size of vortex finders for the entire hydro cyclone		
(e)	Accessory piping within the skid		
(f)	Piping, valves, instruments as per the terminal points defined elsewhere in the specification		
1.2	Secondary hydro cyclone comprising of		
(a)	Hydrocyclone clusters	SET	2
(b)	Anchor bolts, nuts and washers		
(c)	Flanges for inlet and overflow		
(d)	A variety size of vortex finders for the entire hydro cyclone		
(e)	Accessory piping within the skid		
(f)	Piping, valves, instruments as per the terminal points defined elsewhere in the specification		
1.3	Vacuum belt filters complete with accessories	LOT	2
(a)	Vaccum Belt Filter		
(b)	Driving Motor (IE3), Gearbox coupling along with guard		
(c)	VFD & inverter panel		
(d)	Discharge chute with Outlet & Counterflange		
(e)	Maintenance platform with staircase		
(f)	Valves & Instruments as per the terminal points defined elsewhere in the specification		
1.4	Vacuum receivers with anchor bolts, nuts and washers, discharge valves, instrumentation etc. to make system complete.	NOS.	2
1.5	Vacuum pumps with drive (IE3 motor) along with all connecting bolts/ nuts/ washers/foundation bolts for installation, coupling along with guard, required instruments and safety device (as required) to make system complete.	NOS.	2
1.6	Vent fan including enclosure along with drive motor (IE3), coupling along with guard	NOS.	2

BILL OF QUANTITY (BOQ)

1.7	Complete arrangement for cloth and cake washing arrangement, cloth and cake wash pumps with motors (IE3), coupling along with guard, associated piping, valves, spray nozzles & accessories	LOT	1
1.8	Complete arrangement of Vacuum pump seal water sump pumps with motors (IE3), valves, coupling along with guard(as applicable), instrumentation etc. to make system complete.	LOT	1
1.9	Complete interconnected piping (slurry, air and water pipes) along with valves, rubber lining (wherever applicable), supports, gaskets, fasteners and accessories which is integral to Gypsum Dewatering Equipment as defined in technical specification	LOT	1
1.10	Complete instruments associated with equipment and integral piping as defined at 1.9 above for Gypsum Dewatering Equipment.	LOT	1
Notes for Main supply:			
1	Bidder to note that above BOQ for this tender has to be read in conjunction with tender specification. Any item, if not mentioned in above BOQ but indicated in tender specification and required for completion of the system shall deemed to be included in above.		
2	Referring to Technical Specification; **Scope of** Interconnected piping (slurry, air and water pipes) along with instruments, valves, rubber lining (wherever applicable), supports, gaskets, fasteners and accessories which is non integral to Gypsum Dewatering System are **limited to engineering only and supply shall be made by BHEL**. Engineering in bidder's scope includes layout & routing of pipes, preparation of isometric drawing and BOQ.		
SL NO.	**DESCRIPTION**	**UNIT**	**Qty**
2.0	**COST OF SUPERVISION FOR SERVICES**		
2.1	Visits [should include travel expenses to/ fro site, visa/ insurance (if applicable), intermediary stay] for Supervision of assembly, erection and commissioning, trial run at site & tainning to O&M staffs	Nos.	4
2.2	Supervision of assembly, erection and commissioning, trial run at site & training to O&M staffs at Site including, local transportation, boarding, lodging & other related expenses.	days	60
2.3	Successful conductance of Performance Guarantee test and handover in flawless condition of the package to the customer shall include to/ fro site travel expenses, visa/ insurance (as applicable), intermediary stay, local transportation, boarding & lodging & other related expenses.	LOT	1
2.4	Training of employees of customer at manufacturer's works (6 man-days including lodging and boarding)	LOT	1

BILL OF QUANTITY (BOQ)

Notes for Supervision of E&C:		
1	No. of days at site defined at 2.2 above shall be calculated on the basis of presence at site (travel time is excluded).	
2	No. of Visits and days as mentioned at Sl.No.2.1 & 2.2 above may vary, depending upon site requirement. Any variation in no. of visits & no. of days shall be exercised based on unit rate arrived from Sl.No. 2.1 & 2.2 above respectively.	
3.0	**MANDATORY SPARES**	
Sl. No.	**DESCRIPTION**	**Qty**
I.	**MECHANICAL**	
1.22.07	**Hydro-cyclones (Gypsum Primary Dewatering, Secondary Waste Water and any other Hydrocyclone)**	
a.	Hydro-cyclone Isolation Valve	10% of each type OR 1 no. whichever is higher
b.	Hydro-Cyclone	10% of each type OR 1 no. whichever is higher
c.	Hydro-Cyclone rubber lining - feed chamber & overflow chamber	10% of each type OR 1 no. whichever is higher
1.22.10	Slurry Valves	2 no. of each type and size
1.22.11	Slurry Line Bends	2 no. of each type and size
1.22.12	**Vacuum Belt Filter**	
a.	Filter Cloth	2 sets
b.	Belt (if applicable)	1 set
c.	Vacuum Box Seals	2 sets
d.	Drive Motor (if applicable)	1 no.
1.22.13	**Vacuum Breaker Valves**	
a.	Valve Assembly	1 no.
b.	Actuator	1 no.
1.22.14	**Sump Pumps**	
a.	Complete Impeller Assembly	1 no. of each type
b.	Casing Liners	1 set * of each type
c.	Bearing	2 set *
d.	Motor	1 no. of each type and rating
e.	Pump discharge valve assembly	1 no. of each type
1.22.15	**Horizontal Centrifugal Pumps**	
a.	Complete Impeller Assembly	1 no. of each type
b.	Casing Liners	1 set * of each type

BILL OF QUANTITY (BOQ)

c.	Bearing	2 set *
d.	Motor	1 no. of each type and rating
e.	Pump discharge valve assembly	1 no. of each type
II.	**MEASURING INSTRUMENTS**	
2.02.00	**MEASURING INSTRUMENTS**	
(a)	Transmitters of all type, range and model no. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	10%. of each type and model whichever is more
(b)	Temperature elements	
(i)	RTD's	10% or 2 no. of each type, model & length, whichever is more..
(ii)	Thermocouples	10% or 2 no. of each type, model & length, whichever is more..
(iii)	Thermo well for above applications	10% or 2 no. of each type, model & length, whichever is more..
12.01.04	Process actuated switch (Includes all types of Pressure, differential pressure, flow, temperature, level switch Devices).	10% or 1 no. of each type and model
18 (3)	Pressure, Differential Pressure, Flow, level and temperature gauges and all types of Rota meters (as applicable)	1 no. of each range and type
2.03.00	**PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable)**	
1	Valves of all types and models	20 Nos. of each type and model
2	2 way, 3way, 5way valve manifolds	10 Nos. of each type, class, size and model
3	Fittings	100 Nos. of each type
4	Purge meters	20 nos. of each type and model
5	Filter regulators	20 nos. of each type and model
2.05.01	**CONTROL VALVES, ACTUATORS & ACCESSORIES (Following items shall be provided under this clause for all modulating control valves being supplied under this package**	
1	Pneumatic and electro-hydraulic actuator assembly	1 No. of each type, model and rating
2	Diaphragms, O' rings, seals etc. of all types make etc.	5 Nos.
3	Solenoid valves (if applicable)	1 No.
4	Positioner units /smart positioners (complete unit) & accessories (link assembly)	2 Nos.

BILL OF QUANTITY (BOQ)

5	Pneumatic air-filter/Regulator of each type, make rating etc.	2 Nos. of each type
6	Air lock relays	1 No. of each type, model and rating
2.05.02	**PNEUMATICS ISOLATION / BLOCK VALVES, ACTUATORS & ACCESSORIES (For all ON/OFF valves supplied under this package)**	
1	Pneumatic actuator assembly	1 No. of each type, model and rating,
2	Diaphragms, O' rings, seals etc. of all types make etc.	5 Nos.
3	Limit switches (complete unit) & accessories (link assembly)	2 nos.
4	Pneumatic air-filter/Regulator of each type, make rating etc.	2 nos.
2.08.00	**ELECTRICAL ACTUATORS**	
1	Actuators	1 no. of each type and
2	Power unit for modulating actuator	2 nos. of each type
3	DC-DC unit / Power Units	2 nos. of each type
4	Electronic cards	2 nos. of each type
5	Position feedback transmitters	2 nos. of each type
6	Control Unit	2 nos. of each type
7	Torque And limit switch assembly of each unit	2 nos. of each type
8	Electronic PCB of all types	10% of each type & model
9	Absolute Encoder (replaceable part)	5% of each type & model
10	Electronic Torque sensor	5% of each type & model
1.22.06	**VFD System (as applicable)**	
1	**Electronic cards**	
a.	Control modules	1 nos. of each type & rating
b.	I/O module	1 nos. of each type & rating
c.	Power supply modules	1 nos. of each type & rating
d.	Thyristor gate module including gate transformer	100% of one channel
e.	Exciter module	1 no.
2	Complete thyristor bridge leg	1 set
3	Over voltage limiter and surge suppressor network	1 set
4	Semi conductor fuses for thyristor	1 set
5	Power & Control fuse	25% of installed quantity
6	Control Transformer	1 nos. of each type & rating
7	Contactor/Breaker	1 no.
8	CT/VT	1 no. of each type & rating
9	Indicating lamps	100% of each type & rating

BILL OF QUANTITY (BOQ)

10	Auxiliary contactors & relays	1 no. of each type & rating
11	Panel mounted printer	1 no.
12	Indicating lamp holder full set	10% of each type and colour
13	Panel mounted meters	1 no. of each type & rating
14	Current Sensor	1 no. of each type & rating
15	Ground fault sensing card	1 no. of each type & rating
16	Fiber cable with connectors	1 set
Notes for Mandatory Spares:		
1	Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.	
2	Any fraction of a item shall mean the next higher integer.	
3	Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case, the quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.	
4	Wherever the quantities have been indicated for each type, size, thickness, material, radius, range, etc., these shall cover all the items supplied and installed and the breakup for these shall be furnished in the bid.	
5	In case, spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.	
6	(*) Unless otherwise stated, a set shall mean complete replacement for one equipment.	
7	Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidders scope of supply.	

DOCUMENTATION REQUIREMENT

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY ALL THE BIDDERS ALONG WITH THE BID	
Sl. No.	**DOCUMENT TITLE**
1	PQR CREDENTIALS
2	COMPLIANCE SHEET

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY ALL THE BIDDERS AFTER AWARD OF CONTRACT

SN	Doc / Drawing No.	Drawing Title	Remarks Type*	No. of weeks from LOI
1	PE-V0-508-571-A901	MQP for Vacuum Belt Filter along with Sub-Vendor List of Components for GDE.	Primary	4
2	PE-V0-508-571-A902	P&I Diagram with Bill of quantity (BOQ) of GDE.	Primary	3
3	PE-V0-508-571-A903	Control Philosophy of GDE.	Primary	6
4	PE-V0-508-571-A904	Design Philosophy & Sizing Calculation for Gypsum Dewatering Equipment: (a) VBF, (b) Vacuum Receiver, (c) Vacuum Pump, (d) Belt Wash Pump, (e) Cake wash Pumps, (f) Drives and (g) other Accessories for GDE..	Primary	3
5	PE-V0-508-571-A905	GENERAL ARRANGEMENT & LAYOUT OF GDW BUILDING (Showing layout & Foundation details of all the equipments of GDE)	Primary	6
6	PE-V0-508-571-A906	Data Sheet (vacuum belt filter & all accessories of GDE) & General Arrangement Drawings of VBF including cross-sectional details, foundation plan and load details	Primary	6

DOCUMENTATION REQUIREMENT

7	PE-V0-508-571-A907	Piping Layout (Integral-Vendor Scope) with supports & fixing arrangement with BOQ for GDE.	Primary	10
8	PE-V0-508-571-A908	General Arrangement Drawings of (a) Vacuum Pump, (b) Vacuum Receiver, (c) Hydro cyclones (Primary & Secondary), (d) Belt Wash Pump, (e) Cake Wash Pump & (f) Vent Fan, along with cross sectional details, foundation plan and loading details.	Primary	8
9	PE-V0-508-571-A909	Piping Layout (Non-Integral - BHEL Scope) with supports & fixing arrangement with BOQ for GDE.	Primary	10
10	PE-V0-508-571-A910	Instrument schedule along with GA & Data sheet for GDE.	Secondary	----
11	PE-V0-508-571-A911	Data Sheet of Instruments of GDE	Secondary	----
12	PE-V0-508-571-A912	Valve schedule for GDE.	Secondary	----
13	PE-V0-508-571-A913	GA & Data sheet of Valves for GDE.	Secondary	----
14	PE-V0-508-571-A914	Piping Isometric (Integral-Vendor Scope) with supports & fixing arrangement with BOQ for GDE.	Secondary	----
15	PE-V0-508-571-A915	Piping Isometric (Non-Integral - BHEL Scope) with supports & fixing arrangement with BOQ for GDE.	Secondary	----
16	PE-V0-508-571-A916	Block logic diagram & Inter-Connection drawing of GDE.	Secondary	----
17	PE-V0-508-571-A917	Cable Schedule of GDE.	Secondary	----
18	PE-V0-508-571-A918	Electrical load List for GDE.	Secondary	----
19	PE-V0-508-571-A919	Local Panel Control Circuit Diagram of GDE.	Secondary	----
20	PE-V0-508-571-A920	General Arrangement Drawing & Data sheet of Motors for GDE.	Secondary	----

DOCUMENTATION REQUIREMENT

21	PE-V0-508-571-A921	T-S & Performance curves of Vacuum Pump for GDE.	Secondary	----
22	PE-V0-508-571-A922	I/O List (Drives & Instruments) of GDE.	Secondary	----
23	PE-V0-508-571-A923	Utility Consumption of GDE.	Secondary	----
24	PE-V0-508-571-A924	Schedule for Lubrication and other Consumables of GDE.	Secondary	----
25	PE-V0-508-571-A925	Painting Schedule of GDE	Secondary	----
26	PE-V0-508-571-A926	Mandatory Spare List & BBU of GDE	Secondary	----
27	PE-V0-508-571-A927	Platform Drawing of GDE with detailed BOQ	Secondary	----
28	PE-V0-508-571-A928	Erection & Commissioning Manual of GDE including-	Secondary	----
		i). Installation and assembly procedure of complete GDE		----
		ii). Pre-Commissioning Check List of GDE		----
29	PE-V0-508-571-A929	Schedule of Start-up & Commissioning Spares for GDE	Secondary	----
30	PE-V0-508-571-A930	List of Special tools & Tackles for GDE	Secondary	----
31	PE-V0-508-571-A931	Performance Test Procedure of GDE	Secondary	----
List of Documents for BHEL Ref / info.				
1	PE-V0-508-571-A933	Bill of Material (BOM) of complete GDE for Main Supply	Information to BHEL	
2	PE-V0-508-571-A934	Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipments of GDE	Information to BHEL	
3	PE-V0-508-571-A935	Monthly Progress Report for GDE	Information to BHEL	
4	PE-V0-508-571-A936	Packing & Forwarding Details	Information to BHEL	
5	PE-V0-508-571-A937	Packing List of complete GDE	Information to BHEL	

BHEL/Customer comments/approval and Vendor Resubmission schedule

DOCUMENTATION REQUIREMENT

BHEL /Customer Comment/Approval on First Submission	As per schedule given above
BHEL /Customer Comment/Approval on subsequent revision	Within 18 days of Vendor submission/Resubmission
Vendor Resubmission	Within 7 days of BHEL/ Customer Comments.

Number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in the table below:

Sl. No.	Description of Drgs. / Docs.	No. of Prints	No. of Portable Hard Disk
1	Drawings/ Documents		
1.1	First submission and submission with major changes	3	
1.2	Final (Directly to site)	3	2
1.3	"As Built" (Directly to site)	3	2
2	Operation & Maintenance manual i) Final Submission (Directly to site)	3	2

DRAWINGS & DOCUMENTS TO BE SUBMITTED AS FINAL/AS-BUILT DOCUMENT

Sl. No.	DOCUMENT TITLE	SUBMISSION
1	APPROVED DOCUMENTS	Along with dispatch
2	CALIBRATION CERTIFICATES	
3	O&M MANUAL	
4	ALL TEST CERTIFICATES	

COMPLIANCE CERTIFICATE

1	It is hereby confirm that the technical specification (complete) has been read and understood. We confirm compliance to the tender specification including any prebid clarification and amendments issued prior to techno-commercial bid opening without any deviation.
2	It is hereby declared that any technical submittals which was not specifically asked by BHEL in NIT shall not to considered as part of bid and need not be evaluated by BHEL.

Signature of authorised Representative	
Name and Designation :	
Name & Address of the Bidder	
Date	