

AMENDMENT NO. 14 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

31	VI/A	IIC	10 of 33	2.04.14	In order to test the Operating system patches/hot fixes & also other periodic software upgrades, a test server of the same configuration as the servers/workstations provided in HMI will be provided.	In order to test the Operating system patches/hot fixes & also other periodic software upgrades, a test server of the same configuration as the servers/ workstations provided in HMI will be provided.
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24.00.00	Annexure-A Software Based Project Monitoring Tool: Key deliverables of online software based project monitoring tool shall be as follows: 1. Design & Development (Phase-I) – 2 month 2. Implementation (Phase-II) – 2 month 3. Handholding (Phase-III) – 2 months 4. Sustenance (Phase-IV) – 6 months The consultant team shall have adequate Project Management & Technical experts in the required facets of Project Management. Part time engagement of Project Director and Domain experts also are envisaged throughout the lifecycle of the project. For speedy and cost effective solution it is proposed to deploy cloud based solution. Agency shall be closely working with the owner’s team during the above four phases and shall train the owner’s team in carrying forward the system.			
	1.	TECHNICAL / FUNCTIONAL REQUIREMENTS PM software Tool shall help develop capabilities like project scheduling, resource management, and reporting capabilities to deliver the project on-time and within budget. Real-Time availability of critical issues across project execution hierarchy will help to sort out critical issues in time bound manner and arresting delays in Project activities. PM software Tool shall have following capabilities: a) Project Planning L1, L2, L3 Work plan development (e.g., via templates) Preparation of an integrated schedule of Engineering, Supplies & Construction activities with proper linkages. Three months rolling plan (L3) for each package Project front handover and front over to the agency To support timing and scheduling (e.g., via Gantt charts and Pert charts). Control plan creation, modification and deletion To provide project baseline tracking, version control, audit trail and plan history Link multi-level project and task plans. To define project-specific phases, gating processes and milestones		
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	- Integration of T&Ps, Manpower with activities - Integration of existing owner’s Systems viz C-Folder, ECM, Dreams, SAP etc with proposed software solution. b) Project Monitoring/Status Reporting - Monitoring and Alarm generation for Work Fronts, System, Major Milestones and other enablers etc - Project Portfolio management - Dashboards depicting Project Progress based on KPIs for critical information - L2 and L3 network based Gantt, PERT chart, critical path and other MIS reports - Progress monitoring w.r.t. L2 and L3 - Daily/Weekly/Monthly Progress reports. - Tracking of Manufacturing and Supply of Materials as per BBU and linking to L2 schedule. - S Curves for project progress and CAPEX - Top-down and bottom-up visibility for Planners and Project Managers - Multiple scenarios (what if analysis) and data linked to projects during execution - Alerts and reports for control and compliance - Business Intelligence and Analytics - Forecast about critical activities and overall project at any given point of time c) Risk Management - Support project risk assessment and risk mitigation planning. - Quantify project risk. - Quantify project deferral risk (risks if the project is not conducted) - Ability to evaluate risk-reward trade-offs. d) Data Management - Mobile Application for task management, progress updation - Allow users to configure/customize/format views, graphs, and reports. - Create, view, change, and delete projects and associated project data - Accommodate a multiple project		
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e)	- To conduct statistical analysis of historical data (e.g., trend analysis, bench marking). - Import/export/Linking data from existing systems and databases (e.g., planning, financial systems, Engineering, Supply etc.) - Integration of our existing Engineering for drawings, Contracts system for BBU's, ECM and SAP for Finance and other data - Single platform for all projects of owner - Web based interface - Minimal data entry and avoid duplication of data			
	Issue Management Integration with existing issue tracking system			
2.	Scope of work i. Supplying Project Management Software with system license with minimum validity of two years for minimum Fifty (50) concurrent users for : 10 licenses for MIS, 10 licenses for Planning and 30 licenses for Data Punching. ii. Assess current status of the project and critically review the existing schedules and systems. Suggest a system to guide the project and develop and implement the same in consultation with Employer. Crash the schedule in case of need. iii. Create a dashboard for monitoring and track the missing targets and identify the responsible team. iv. Review current practices of reporting and to find gaps. Improve the current system by including latest technology and tools. v. Review the existing milestones, correlation with project, pre-commissioning and commissioning activities and availability of work front. vi. Combined schedule for monitoring the project and Managing Project baselines in terms of progress and cost. vii. Web based accessed system, Mobile apps for dashboard and data updation.			
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2.1.	KEY DELIVERABLES Key deliverables shall be as per Supply and the four Phases of implementation 1. SUPPLY OF PROJECT MANAGEMENT SOFTWARE WITH SYSTEM LICENSE (FOR 2 YEARS) – WITHIN 2 MONTHS FROM START OF WORK 2. DESIGN & DEVELOPMENT (PHASE-I) – 2 MONTHS a) Integrated Schedule Development b) Project KPIs, roles and responsibilities for all key stakeholders c) Activity break down structure, shall create a detailed Project Schedule with proper linkages d) Project baselines e) Gap analysis f) Capability Development Roadmap g) Ensure that the system is capable of being extended to other projects of owner by owner’s team members h) Define Governance and Escalation Points i) Define and Design Risk Issue Management Process j) Define and Design Communication Strategy k) Define Process Automation Scope l) Roadmap for Integration of existing owner’s /Agency Systems viz C-Folder, ECM, Dreams, SAP etc. with proposed software solution m) Submission of Blueprints 3. IMPLEMENTATION (PHASE-II) – 2 MONTHS a) Configure Standard Reports, e.g, Project Status, Summary b) Develop Custom Reports and Dashboard Format c) Roll out of Daily/Weekly/Monthly Progress reports d) Critical path report e) Work front tracker for highlighting work front constraints (Fortnightly) f) Integration of existing owner’s /Agency Systems viz ECM, Dreams, SAP etc with proposed software solution g) L2 and L3 network based Gantt, PERT chart, critical path and other MIS reports h) Financial / Cost reports i) Web based as well as Mobile app based access to users 4. HANDHOLDING (PHASE-III) – 2 MONTHS a) Training and handholding support for the project team members			
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- b) Site visits and support for Data updation
- c) Changes and enhancement on feedback
- d) Process Manuals and documentations
- e) Conducting sessions through VC
- f) Conducting Training Sessions (Breakup as below)

S. No.	Training type	No of training	No of man day each training	Total training man days
1.	System Administration and Maintenance Training	2	2	4
2.	End Users Training at Site/CC	6	2	12
3.	Planning User training at Site/CC	6	2	12
4.	Senior Level Training	6	½	3
5	Train the trainers	2	2	4
Total				35

5. SUSTENANCE (PHASE-IV) – 6 MONTHS

- a) Post Implementation Handholding
- b) User acceptance testing
- c) Project plan update with Team Member (Monthly)
- d) Automated advance alert for project delays to all the related stakeholders
- e) Updated Daily /weekly / Monthly project progress reports
- f) Project Maturity Assessment
- g) High availability of cloud platform
- h) Capacity building training for Owner
- i) Periodic backup of data in Owner's systems
- j) 2 days Site visit, twice in a month
- k) Recommendations
- l) Installation of Backup system/software with minimal configuration at Owner's place

6. HELP DESK AND SUPPORT FOR 2ND YEAR- 1 YEAR

- a) Identification of Major Project Milestones for timely achievement (2 milestones in each Project).
- b) Remote (Telephone/ E-mail / internet / Installation visit) or In-Person (wherever required) support to be provided. One nodal person to be identified.
- c) Development and modification in Dashboards/Reports
- d) SLA reports, Monthly and quarterly utilization reports (peak and average volumetric details)
- e) Monthly visit at PP&M to review and resolve issues pending / bugs
- f) Handholding owner for implementing New Project Plans and systems
- g) Ensure smooth running of the system

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2.2.	DEPLOYMENT SCHEDULE			
	a) Consultants deputed by bidder shall be professionally qualified and have the experience and deployment as envisaged below			
	S. No.	Role	Experience	
	1	Project Director	~15 years of experience in Project/ Programme management, project risks and execution management in large infrastructure projects, as defined elsewhere in the document	
	2	Project Manager	~10 years of experience in Project management, project risks and execution management in Power plant construction and Execution	
	3	Technical Lead	~10 years of experience in development/ implementation of PM Software including web, mobile apps and capability in interfacing with Owner’s systems	
	4	Monitoring consultant	~5 years of onsite experience of Power project execution and monitoring	
	5	MIS Expert	~12 experience in designing reporting frame work, risk registers, project delivery process, intelligent project monitoring templates & BI templates	
	2.3.	b) It is required to provide a list of the consultants proposed to be deployed for this project along with the proposal. The list should include a brief on qualification, experience and projects undertaken by each of the Consultant.		
		c) Additional Consultants will however be deployed as per requirements. But no additional payment shall be made. It is assumed that the payment has been included in the financial proposal.		
d) Consultants to be deployed should be on the rolls of company for at least 1 year.				
24.01.00	PROJECT LOCATION AND OTHER INFORMATION			
	Refer details provided elsewhere in the specification			
24.01.00	Special conditions			
	a) No Server hardware will be provided by owner as solution is cloud based.			
	b) For connecting internal system of owner suitable hardware / software for secured access is to be provided and configured by agency in consultation with owner.			
24.01.00	c) The change of consultant during execution of the project shall not be allowed. However, in exceptional circumstances with the permission of EIC, the replaced			
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	consultant should have the above experience and seamlessly be able to integrate with the job including proper knowledge transfer. d) Suitable accommodation will be provided at site during site visit subject to availability. e) Start Date of the work would be reckoned as 30 days from the Date of Award. Hence, the successful bidder shall depute the implementation team within that period under intimation to the EIC. The office space and facility shall be provided by owner. f) If the Engineer-in-Charge if not satisfied with the work of manpower deputed for the work, he may insist for replacement through written notice. After receiving such notice, the consultant shall depute replacement manpower with above experience within 3 days. g) The consultants deployed by bidder shall carry their own Laptop for execution of work. h) The total working during man-month is based on the calculation as per standard industry practice and shall be in line with the working hours and days of owner executives at location. It is the responsibility of bidder to ensure the availability of consultants. i) The Services for “Support for 2nd Year onwards for Three Projects” will commence only after completion of all 4 phases on implementation, on certification to that effect by the EIC.			
24.02.00	SOFTWARE / CLOUD			
	a) Platform as a Service (PaaS) on the cloud including infrastructure b) Shall comply or meet any security requirements applicable to CSPs/Service Providers published (or to be published) by MeitY or any standards body setup / recognized by Government of India from time to time and notified to the CSP/Service Providers by MeitY as a mandatory standard. c) The CSP/Service Provider shall meet all the security requirements indicated in the IT Act 2000, the terms and conditions of the Provisional Empanelment of the Cloud Service Providers and shall comply to the audit criteria defined by STQC d) All the software procurement, installation for connection to ECM, Engg, CC&M or other systems shall be in scope of agency e) Suitable workload for licenses procured to be provided on the cloud platform f) Licenses will be in the name of Owner thru EULA g) Data Retrieval /Backup to local as and when required h) Data and platform security as per standards Guidelines issued by Ministry of Electronics and Information Technology. i) Software & Licenses for PM tool j) Software & licenses for Database Solution k) Software & licenses for Backup Solution (if applicable)			
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24.03.00	l) Software & licenses for Software for Application Server (if applicable) Connectors m) Exit Management Plan and migration to Other system if required n) Any other software components required o) Application Programming interface (API) for development p) Multi user access q) Minimal Customization of the standard solution r) Application for updates and patches throughout licensing period s) Further, during this period, it will be the responsibility of the agency to maintain and support the system fully and ensure that the level of availability is 95% t) Cloud Licenses will be for minimum of Two years with option for extending the licenses for at least two more years after completion of facilities of last unit in the project.			
	LIQUIDATED DAMAGES			
	1.0 APPLICABLE FOR SUPPLY AND PHASE-I TO PHASE-IV OF IMPLEMENTATION			
	Supply: In the event of Supplier’s failure to deliver the material of acceptable quality within the stipulated delivery period, the liquidated damages are payable by the Supplier @ 0.5% (one half of one percent) per week of delay or part thereof, of the unexecuted total item value Implementation: In the event of Supplier’s failure to complete the phase wise implementation within the stipulated period, the liquidated damages are payable by the Supplier @ 0.5% (one half of one percent) per week of delay or part thereof, of the unexecuted total item value. LD levied for each of the phases of implementation, whenever applicable, are independent of each other and are applicable separately and concurrently. However, the total liability of the bidder under this clause shall not exceed 5% of the Total Implementation Cost. However, in case of delay due to reasons beyond the control of the Consultant, suitable extension of time may be granted.			
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2.0 APPLICABLE FOR 2ND YEAR WORK

Sr. No. (a)	Measurement (b)	Definition (c)	Target (d)	LD (e)
1	Business Standstill	If the solution is unavailable either due to software bug or cloud unavailability and blocks the execution of the primary business process. A workaround is not possible. A business-critical part of an application is not available. A workaround is not possible. Business-critical function cannot be executed. A workaround is not possible.	Resolution Within 0-6 hours	Nil
			Resolution Within 6 hours- 1day	(Total Year charges for Support for 2 nd Year) / 365 X 1
			Resolution beyond 1 day	2 X (Total Year charges for Support for 2 nd Year) / 365 X No of days
2	Regular Fault	- A non-business critical part of an application is unavailable. A workaround is not possible but the user is able to achieve a normal productivity level. - The problem has few consequences for the user and workaround is possible. Most of the functions operate normally.	Resolution Within 1 day	Nil
			Resolution Within 1- 5 days	(Total Year charges for Support for 2 nd Year) / 365 X No of days
			Resolution beyond 5 days	2 X (Total Year charges for Support for 2 nd Year) / 365 X No of days
3	No immediate impact to business	The problem has few consequences for the user and there is a workaround. The application or its parts are used by a very few users & the unavailability will not affect business.	Resolution Within 2 days	Nil
			Resolution Within 2- 10 days	(Total Year charges for Support for 2 nd Year) / 365 X No of days
			Resolution beyond 10 days	2 X (Total Year charges for Support for 2 nd Year) / 365 X No of days
4	Absence of Executive Consultant	As per requirement in different phases	Upto 2 working days in a month	Nil
			2-7 working days in a	Rs 5000 per day per person

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			month	
			more than 7 working days in a month	Rs 10000 per day per person
5	Non Achievement of Major Project Milestones in three Projects	Milestones will be minimum and not limited to the milestones as identified in bid documents and shall be jointly finalized by bidder and owner. If there is any delay beyond the control of agency which accepted by owner an extended time is provided, then target time will be extended	No delay	NIL
			Delay upto 2 Months	5 X (Total Year charges for Support for 2 nd Year) / 365
			Delay beyond 2 Months	10 X (Total Year charges for Support for 2 nd Year) / 365

24.04.00

PENALTY FOR ATTRITION OF PROJECT TEAM MEMBER(S)

a) For all incidents of replacement of key personnel beyond two, Consultant shall be penalized for bad delivery and material breach. Penalty for each such replacement of key personnel shall be INR 1 lacs.

b) In the event that the owner identifies any personnel of Consultant as “Key Personnel”, then Consultant shall not replace such personnel without a notice period of not less than two months to owner and prior written consent of the owner, unless such replacement is the result of an unavoidable circumstances like termination due to incompetence/unethical practices/etc, medical leave, death (or any other similar reason to be solely decided by owner in each case) and insistence of owner due to reasons stated in subsequent paras. After statutory notice by Consultant and written consent of owner, the substitution of such key personnel shall be accomplished pursuant to a mutually agreed upon schedule but not later than 15 Days prior to the date of exit of such personnel and with a minimum overlapping period of 15 working days with complete onsite knowledge transfer among the two key personal (i.e. outgoing and incoming). Knowledge transfer shall be documented in detail with one copy to CLIENT for approval. If replacements do not take as stipulated here, owner will penalize the Consultant for bad delivery and material breach. Penalty for each such failure of Consultant in replacement of key personnel shall be Rs. One lac. Any delay in replacing the resource by more than 07 days from the time stipulated above shall be penalized at the rate of Rs. 50,000/- per seven days delay (up to a maximum of Rs. 10 Lakh) till the time resource is suitably placed on job.

c) Under any circumstances when the Key Personnel are to be replaced, Bidder shall always and immediately put forward the profiles of personnel being proposed as replacements. These profiles should be either equivalent or better than the ones being

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	replaced and shall be suitable match in competence. However, whether these profiles are better or equivalent to the ones being replaced will be decided solely by owner within a period of 3 working days (excluding the day of providing the profiles). Owner will have the right to accept or reject these substitute profiles. The replacement will be on board only after owner accepts the replacement. Time involved in this activity is included in the total time for replacement. d) Owner by notice to the Bidder may object to any representative or person employed by the Consultant in the execution of the contract who, in reasonable opinion of the owner, may have behaved inappropriately, found to be unsuitable for the role for which deployed, negligent or is involved in unethical practices. Consultant shall remove such person unconditionally from work on the contract and promptly appoint a replacement as per the above methodology.		
24.05.00	DOCUMENTS PREPARED BY THE BIDDER TO BE PROPERTY OF THE OWNER a) All reports, manuals, and other documents (collectively referred to as “Project Documents”) submitted by the Bidder in performing the Services shall become and remain the property of the owner, and all intellectual property rights in such Project Documents shall vest with the owner. Any Project Document, of which the ownership or the intellectual property rights do not vest with the owner under law, shall automatically stand assigned to the owner as and when such project Document is created and the Consultant agrees to execute all papers and to perform such other acts as owner may deem necessary to secure its rights herein assigned by the Owner. b) The Bidder shall, not later than termination or expiration of this Agreement, deliver all Project Documents to the owner, together with a detailed inventory thereof. The Consultant shall not retain any of such Project Documents. The Consultant, its Sub-Consultant or a Third Party shall not use these Project Documents for purposes unrelated to this Agreement without the prior written approval of the owner. c) The Bidder shall hold the owner harmless and indemnified for any losses, claims, damages, expenses (including all legal expenses), awards, penalties or injuries (collectively referred to as “Claims”) which may arise from or due to any unauthorised use of such Project Documents, or due to any breach or failure on part of the Consultant or its Sub-Consultant or a Third Party to perform any of its duties or obligations in relation to securing the aforementioned rights of the owner. d) Personnel assigned by the Bidder to perform the Services and under no circumstances shall such personnel be considered employees of owner. The Consultant shall have the sole responsibility for the supervision and control of the personnel deployed in the Project and for payment of such personnel’s compensation, including salary, withholding of income taxes and social security taxes, worker’s compensation, employee		
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24.06.00	and disability benefits and the like and shall be responsible for all obligations of Client subject to Applicable Law. e) Each Party shall be responsible for the performance of all its obligations under this Agreement or the SLA as the case may be and shall be liable for the acts and omissions of its employees and agents in connection therewith. Neither Party will solicit for employment or knowingly hire an employee of the other Party with whom such Party has contact pursuant to project engagements under this Agreement. This restriction shall not apply to employees of either Party responding to advertisements in job fairs or news media circulated to the general public. 1.1. TRANSFER OF ASSETS a) Owner shall be entitled to serve notice in writing to the Bidder at any time during the exit management period as detailed herein above requiring the Bidder to provide the owner with a complete and up to date list of the Assets within one week of such notice. Owner shall then be entitled to serve notice in writing on the Bidder at any time prior to the date that is 30 days prior to the end of the exit management period for transfer of all assets as per mutually agreed schedule to owner. b) In case of contract being terminated, owner reserves the right to ask Bidder to continue running the project operations for a period up to 6 months after termination orders are issued. c) Upon service of a notice under this Article the following provisions shall apply: i. Payment to the outgoing Bidder shall be made to the tune of last set of successfully completed services / deliverables as per contract, subject to SLA requirements. 1.2. CONFIDENTIAL INFORMATION, SECURITY AND DATA The Bidder will promptly on the commencement of the exit management period supply to the owner the following: i. Information and data relating to the current services rendered; ii. Documentation relating to the project’s Intellectual Property Rights; iii. All current and updated data in a readily available format as is reasonably required for purposes of owner taking over the system or transitioning the services to its Replacement Bidder nominated by the owner. 1.3. TRANSFER OF CERTAIN AGREEMENTS On request by the owner, the Bidder shall effect such assignments, transfers, licenses and sublicenses as owner may require in favour of the owner or its Replacement Bidder in		
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	relation to any equipment lease, maintenance or service provision agreement between Bidder and third party lessors, vendors, and which are related to the services and reasonably necessary for the carrying out of replacement services by the owner or its Replacement Bidder. a) During the exit management period, the Bidder shall use its best efforts to deliver the services. b) Payments during the Exit Management period shall be made in accordance with the Terms of Payment Schedule. c) This Exit Management plan shall be furnished in writing to the owner within 30 days from the Date of award.		
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1.00.00	TYPE TEST REQUIREMENTS		
1.01.00	General Requirements		
1.01.01	The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. If the bidder proposes a different standard/code from that indicated at clause no 2.01.00 and at table 3.00.00, same is acceptable provided the equivalence of the proposed standard is established by the bidder. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR OTHER C&I SYSTEMS' at the end of this chapter and under the item “Special Requirement for Solid State Equipments/Systems”. (a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests. (b) For the rest, submission of type test results and certificate shall be acceptable provided. i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment. ii. There has been no change in the components from the offered equipment & tested equipment. iii. The test has been carried out as per the latest standards along with amendments as on the date of Bid opening. (c) 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.		
1.01.02	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.		
1.01.03	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.		
1.01.04	The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.		
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS		
2.01.00	The type test reports which are to be submitted for each of the C&I systems(indicated in clause 2.01.01) shall be as indicated below: i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems		
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2.01.01	All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI / IEEE C37.90.1.. Hence, all front end cards/ devices which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI / IEEE C37.90.1. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to compliance to ANSI / IEEE C37.90.1, the system shall comply to IEC-61000-4-4, IEC-61000-4-5 and IEC-61000-4-18. ii) Dry Heat test as per IEC-60068-2-2 or equivalent. iii) Damp Heat test as per IEC-60068-2-30 or IEC-60068-2-78 or equivalent. iv) Vibration test as per IEC-60068-2-6 or equivalent. v) Electrostatic discharge tests as per IEC 61000-4-2 or equivalent. vi) Radio frequency immunity test as per IEC 61000-4-6 or equivalent. vii) Electromagnetic Field immunity as per IEC 61000-4-3 or equivalent. C&I Systems- <table><tr><th>Sl. No</th><th>Item</th><th>Remark</th><th>Test To Be Specifically Conducted</th><th>NTPC's Approval Req. On Test Certificate</th></tr><tr><td>1</td><td>Control System of DDCMIS</td><td></td><td>No</td><td>Yes</td></tr><tr><td>2</td><td>PLC, excluding its HMI</td><td>Not applicable for integral PLCs and PLCs which are governed by standard practice of OEM</td><td>No</td><td>Yes</td></tr><tr><td>3</td><td>VMS System (Applicable for each module of VMS)</td><td></td><td>No</td><td>Yes</td></tr><tr><td>4</td><td>Main Turbine & BFP Drive Turbine TSI System (Applicable for each module of TSI System)</td><td></td><td>No</td><td>Yes</td></tr><tr><td>5</td><td>Vibration Analysis System (Applicable for each module of Vibration Analysis System)</td><td></td><td>No</td><td>Yes</td></tr></table>					Sl. No	Item	Remark	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate	1	Control System of DDCMIS		No	Yes	2	PLC, excluding its HMI	Not applicable for integral PLCs and PLCs which are governed by standard practice of OEM	No	Yes	3	VMS System (Applicable for each module of VMS)		No	Yes	4	Main Turbine & BFP Drive Turbine TSI System (Applicable for each module of TSI System)		No	Yes	5	Vibration Analysis System (Applicable for each module of Vibration Analysis System)		No	Yes
	Sl. No	Item	Remark	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate																														
	1	Control System of DDCMIS		No	Yes																														
	2	PLC, excluding its HMI	Not applicable for integral PLCs and PLCs which are governed by standard practice of OEM	No	Yes																														
	3	VMS System (Applicable for each module of VMS)		No	Yes																														
	4	Main Turbine & BFP Drive Turbine TSI System (Applicable for each module of TSI System)		No	Yes																														
	5	Vibration Analysis System (Applicable for each module of Vibration Analysis System)		No	Yes																														
	KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS																														
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6	TG related Special modules like Auto synchronizer, Load transducer module and speed measurement module		No	Yes
7	Master Clock		No	Yes

Note:

Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.

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3.00.00	TYPE TEST REQUIREMENT FOR OTHER C&I SYSTEMS					
	Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
	1	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes
	2	Instrumentation Cables Twisted & Shielded*				
		-Conductor	Resistance test	VDE-0815	No	Yes
			Diameter test	IS-10810	No	Yes
			Tin Coating test (Persulphate test)	IS-8130	No	Yes
		-Insulation	Loss of mass	VDE 0472	No	Yes
			Ageing in air ovens**	VDE 0472	No	Yes
			Tensile strength and elongation test before and after ageing**	VDE 0472	No	Yes
			Heat shock	VDE 0472	No	Yes
			Hot deformation	VDE 0472	No	Yes
			Shrinkage	VDE 0472	No	Yes
			Bleeding & blooming	IS-10810	No	Yes
		-Inner sheath***	Loss of mass	VDE 0472	No	Yes
			Heat shock	VDE 0472	No	Yes
		Cold bend/cold impact test	VDE 0472	No	Yes	
		Hot deformation	VDE 0472	No	Yes	

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CLAUSE NO.	 TECHNICAL REQUIREMENTS 				
		Shrinkage	VDE 0472	No	Yes
	-Outer sheath	Loss of mass	VDE 0472	No	Yes
		Ageing in air ovens**	VDE 0472	No	Yes
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472	No	Yes
		Bleeding & blooming	IS-10810	No	Yes
		Colour fastness to water	IS-5831	No	Yes
		Cold bend/ cold impact test	VDE-0472	No	Yes
		Oxygen index test	ASTMD-2863	No	Yes
		Smoke Density Test	ASTMD-2843	No	Yes
		Acid gas generation test	IEC-60754-1	No	Yes
	-fillers	Oxygen index test	ASTMD-2863	No	Yes
		Acid gas generation test	IEC-60754-1	No	Yes
	-AL-MYLAR shield	Continuity test		No	Yes
		Shield thickness		No	Yes
		Overlap test		No	Yes
	-Over all cable	Flammability	IEEE 383	No	Yes
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CLAUSE NO.	एनटीपीसी NTPC TECHNICAL REQUIREMENTS 																																								
	Test <table><tr><td>Swedish Chimney Test</td><td>SEN 4241475</td><td>No</td><td>Yes</td></tr><tr><td>Noise interference</td><td>IEEE Trans-actions</td><td>No</td><td>Yes</td></tr><tr><td>Dimensional checks</td><td>IS 10810</td><td>No</td><td>Yes</td></tr><tr><td>Cross talk</td><td>VDE-0472</td><td>No</td><td>Yes</td></tr><tr><td>Mutual capacitance</td><td>VDE-0472</td><td>No</td><td>Yes</td></tr><tr><td>HV test</td><td>VDE-0815</td><td>No</td><td>Yes</td></tr><tr><td>Drain wire continuity</td><td></td><td>No</td><td>Yes</td></tr></table> * 1.0 All cables to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last Ten years from the date of bid opening. These reports should be for the tests 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. 2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last Ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval. **These tests shall be carried out as per VDE0207 Part 6 & ASTM-D-2116 for TEFLON insulated & outer sheathed cables ***Applicable for armoured cables only 3 DC Power Supply System (Applicable for each model and rating) 1)The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable <table><tr><td>Surge Withstand Capability(SWC)</td><td>(ANSI / IEEE C37.90.1)or (IEC-61000-4-4, IEC-61000-4-5 and IEC-61000-4-18).</td><td>No</td><td>Yes</td></tr><tr><td>Dry Heat Test</td><td>IEC-60068-2-2 or equivalent</td><td>No</td><td>Yes</td></tr></table>					Swedish Chimney Test	SEN 4241475	No	Yes	Noise interference	IEEE Trans-actions	No	Yes	Dimensional checks	IS 10810	No	Yes	Cross talk	VDE-0472	No	Yes	Mutual capacitance	VDE-0472	No	Yes	HV test	VDE-0815	No	Yes	Drain wire continuity		No	Yes	Surge Withstand Capability(SWC)	(ANSI / IEEE C37.90.1)or (IEC-61000-4-4, IEC-61000-4-5 and IEC-61000-4-18).	No	Yes	Dry Heat Test	IEC-60068-2-2 or equivalent	No	Yes
Swedish Chimney Test	SEN 4241475	No	Yes																																						
Noise interference	IEEE Trans-actions	No	Yes																																						
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Surge Withstand Capability(SWC)	(ANSI / IEEE C37.90.1)or (IEC-61000-4-4, IEC-61000-4-5 and IEC-61000-4-18).	No	Yes																																						
Dry Heat Test	IEC-60068-2-2 or equivalent	No	Yes																																						
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		Damp Heat test	IEC-60068-2-30 No or IEC-60068-2-78 or equivalent	No	Yes	
		Vibration test	IEC-60068-2-6 or equivalent	No	Yes	
		Electrostatic discharge test	IEC 61000-4-2 or equivalent	No	Yes	
		Radio frequency immunity test	IEC-61000-4-6 or equivalent	No	Yes	
		Electromagnetic field immunity	IEC 61000-4-3 or equivalent	No	Yes	
		Degree of Protection	IS-13947 or equivalent	No	Yes	
	4	Battery ##	As per standard (col 4)	IS-10918 (Ni-Cd Batteries)	No	Yes
				IS-1652 (Lead Acid Plante Batteries)	No	
	5	UPS (Applicable for each model and rating)				
		1) Type Test reports of same series of UPS with similar PCB's cards and controllers as the target UPS system shall be acceptable.				
		2) For Dry heat, Damp heat and vibration, the tests conducted on individual PCB's shall be acceptable.				
		Surge Withstand Capability(SWC)	(ANSI / IEEE No C37.90.1)or (IEC-61000-4-4, IEC-61000-4-5 and IEC-61000-4-18).	No	Yes	
		Dry Heat Test	IEC-60068-2-2 or equivalent	No	Yes	
		Damp Heat test	IEC-60068-2-30 No or IEC-60068-2-78 or equivalent	No	Yes	
	Vibration test	IEC-60068-2-6 or equivalent	No	Yes		
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		Electrostatic discharge test	IEC 61000-4-2	No or equivalent	Yes
		Radio frequency immunity test	IEC-61000-4-6	No or equivalent	Yes
		Electromagnetic field immunity	IEC 61000-4-3	No or equivalent	Yes
		Degree of protection test	IS-13947	No	Yes
		Fuse Clearing Capability	Approved procedure	No	Yes
		Short Circuit current capability	IEC 60146-2	No	Yes
6	Public Address System				
	IP based PA system components	As per Standard	IEC 60268-16	No	Yes
7	Control Valves	CV test	ISA 75.02& 75.11	No	Yes
8	Flow Nozzle Orifice plates	Calibration	ASME PTC BS 1042	No	Yes
## The contractor shall submit for Employers approval the reports of all the type test as per latest IS-10918 carried out within last ten years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence of owner's representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier.					
Note:					
Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.					
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS	
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
	STEAM AND WATER ANALYSIS SYSTEM (SWAS)		
1.00.00	STEAM AND WATER ANALYSIS SYSTEM (SWAS)		
1.01.00	The purity of the condensate, feed water, steam etc. shall be continuously monitored through online analysis system. The exact sample points, their location, type of chemical analysis to be carried out for each sample, measurement ranges etc., shall be subject to the approval of the Employer. The system shall be designed in accordance to the recommendations of latest versions of ASME PTC 19.11, ASTM D 1066, ASTM D 3370 and ASTM D 5540.		
1.02.00	The Contractor shall provide the chemical analysis system as a composite system including sample piping, valves, grab sample collection facility, gauges/indicators, coolers, on-line analyzers etc. The SWAS shall include the following as a minimum meeting the technical requirement as indicated herein.		
1.03.00	The Contractor shall be fully responsible on system basis, for proper engineering, selection of hardware, manufacture, testing, installation, commissioning and satisfactory functioning of complete and fully operational steam and water analysis system meeting the intent of this specification. All system components and accessories required for completeness of this system shall be furnished by the Contractor although these may not be individually specified herein. All system components shall be completely assembled, piped, wired and tested at the factory and shall be ready for installation when received at the project site.		
1.04.00	All piping, tubing, fittings and other wetted parts in the sampling and analyzing system shall be of ASTM A182/213/312-316SS Grade material for the service approved by the Employer. No plastics or rubber shall be permitted except within analysers as recommended by the manufacturer.		
1.05.00	Information and alarm signal from SWAS system including analyzers/monitor output signals, chiller system etc. shall be hooked up to DDCMIS for monitoring purpose.		
1.06.00	All sample tap-off shall be designed for collecting the isokinetic sample complying the code ASTM D1066 (refer Sub-section-A-03 Steam Generator & Auxiliaries Including ESP Chapter, Part-B of technical specification).		
2.00.00	SWAS PANELS		
2.01.00	The SWAS panels shall comprise of two panels viz. Secondary Sample Conditioning Panel (Wet Panel) and Analyser Panel (Dry Panel). Wet panel shall house bulk head type fittings, removable cartridge type filters, pressure reducing elements, flow rate control, secondary coolers, grab sample valve and other sample conditioning equipments. For each sample, pressure gauge, temperature gauge, flow indicator, back pressure regulating valve, grab sample valve shall be provided on front of panel. The grab sampling facility and quick disconnect patch board facilities shall be provided on this panel.		
2.02.00	Dry Panel shall house cells, analyzers, monitors etc.		
2.03.00	The above panels shall be physically separate from each other and shall be mounted in the air-conditioned SWAS room- Wet panel shall be corridor type with walkway construction with side doors & removable type plate at the back. The dry panel shall be free standing & totally enclosed construction with back doors. The panels shall be constructed of 2.5mm thick SS316 plates except for doors, which shall be of 2.0mm thickness SS316 plate. The panel floor shall be made of SS 316 sheet of 5mm thickness with central flat portion for walk way and slightly sloping sections towards front and rear side and a panel drain. The waste water/sample from panel drain shall be piped to the nearest plant drain. All piping shall be concealed/ through trenches. The overall dimensions of wet panel and dry panel shall be 3300(W)x2400(H)x2000(D)mm and 3500(W)x2400(H)x1000(D)mm respectively as a		
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	minimum. However, increase in panel size, if required, shall be taken care of by the Contractor without any price implications to the Employer. All SWAS panels shall be furnished with 100mm base angle for bolting to 100mm high concrete. The foundation details, layout and general arrangement of these panels shall be subject to Employer's approval. Wet and dry panels of not more than two units shall be placed in one SWAS room.		
2.04.00	Arrangement of equipment shall be generally as per ASME PTC 19.11 subject to Employer approval during detail Engineering.		
2.05.00	PC-based operator station, with color laser printer for monitoring & alarming (Hooked up to station wide LAN of the DDCMIS system) (for PC specification, refer Sub-Section: DDCMIS) shall be provided by the Contractor.		
2.06.00	SAMPLE CONDITIONING SYSTEM		
2.06.01	The sample conditioning system (Wet Panel) shall provide samples at 25°C or a preset temperature required by the analyzer within tolerance of ±1°C, at a pressure of about 2kg/cm2 and at flow rates as required by individual analyzers/streams. Sample line to analyzer elements shall incorporate an anti-siphon design to prevent possibility of running dry because of a broken or plugged sample line. All fittings, pipes & other wetted parts shall be ASTM A182/312 316SS.		
2.06.02	Sample conditioning system shall be designed and constructed to receive and condition all samples as required by the respective analyzers connected to the sample streams. This will include all conditioning as specified herein and shall cover the followings: a) Primary sample cooling (wherever specified) in the field. b) High pressure reduction (wherever specified) in the field. c) Two nos. racks shall be provided per unit by the Contractor for mounting primary coolers and high pressure reducing elements in the field along with all required piping, fittings, and accessories. The exact grouping and location of these racks shall be as finalized during detail engineering stage. d) Sample filtering. e) Secondary sample cooling and temperature control. f) Pressure reduction and control as required. g) Flow rate control and measurement. h) Other treatment as required by individual analyzers or as specified herein.		
2.07.00	Primary cooling of all samples having temperature in excess of 45°C shall be provided through an individual sample cooler (primary cooler) with SS304 body, submerged helical coil (SS316H) type of shell and tube design with removable shell. The primary coolers shall use condensate quality (DM) plant equipment cooling water. The design, construction materials and technical features of the cooler shall be subject to Employer's approval. However, the sizing of the coolers should consider total sample flow plus 500ml/min grab sample & a fouling factor of 0.2. The capacity calculation shall be subject to Employer's approval during detailed engineering. All the pipes, fitting & valves required for cooling water for the primary coolers (supply and return lines) shall be provided by the Contractor. Provision shall be made for heat exchanger shell drain duly valved and piped to waste drain header by the Contractor.		
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 			
2.08.00	The Contractor shall also provide pipe from the waste drain header to the nearest building drain. Thermal protection devices (Thermal shut-off valve) as per ASME PTC 19.11 (Section 5) to be provided in the sample lines at the primary cooler outlets. All the pipes, fitting & valves in the primary rack shall be of SS316H. Each sample stream with the required flow rate shall be finally cooled to 25°C±1°C or to a preset temperature required by the analyzer through an individual secondary cooler before passing the sample to the respective measuring cells and analyzer. The capacity calculation (considering fouling factor of 0.2) shall be subject to Employer's approval during detailed engineering. The secondary cooler shall also use condensate quality chilled water at 20°C. Chilled water for secondary cooler shall be provided by packaged refrigeration unit (chillers) to be provided by the Contractor. All samples will be passed through cartridge type filters before being cooled in respective secondary coolers. The secondary coolers shall also be of submerged helical coil (SS316) type of shell and tube design with SS304 body. Secondary cooler shall be protected by a relief valve on the cooling water jacket of each cooler in addition to a relief valve at the cooling water header. Provision shall be made for heat exchanger shell drain duly valved and piped to waste drain header to be supplied by the Contractor. The Contractor shall also provide pipe from the waste drain header and connect to the nearest building drain.			
2.09.00	Chiller System (1) One set of 2x100% capacity water cooled chillers shall be provided by Contractor in each SWAS room. (2) Each chiller unit shall be designed with sufficient refrigeration capacity to ensure each sample stream temperature to 25°C±1°C when all streams are simultaneously at maximum flow rate and maximum temperature. The chiller capacity shall have a provision of 25% spare capacity for future samples. (3) Suitable temperature monitoring and control systems shall be provided for maintaining the chilled water temperature at chiller outlet at 20°C or at a designed preset value and within the desired band. (4) The compressor shall be readily accessible for service and shall include low noise hermetically sealed motors. Compressor assembly shall also include crank case heaters, suction and discharge valves, oil sight glasses, forced feed lubrication system and an integrated motor protection system along with the necessary instruments. (5) The condenser shall be water cooled, cleanable shell and tube with water regulating valve. The cooling water shall be arranged by Contractor from Equipment Cooling Water System of TG Package. All the pipes, fittings & valves required for to take the water from customer tapping point to the chiller shall be provided by the Contractor. (6) Chiller shall be of the direct expansion type with refrigerant tubes inside a shell, completely insulated and to be constructed in accordance with the ASME code for unfired pressure vessels. (7) Refrigerant circuit shall be complete with a thermostatic expansion valve, liquid line solenoid valve, sight glasses, filter-dryer, refrigerant shut-off and charging valves. (8) The chiller water pump shall be of the centrifugal type, close coupled, bronze fitted construction, complete with motor. Pump & motor shall be designed for continuous operation. (9) Vibration dampeners shall be mounted between the packaged chiller and the channel base. (10) Cooling water and chilled water piping shall be provided with block valves.			
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2.10.00	(11)	The Contractor shall provide detailed calculation for chiller capacity and other technical particulars like foundation details/mounting etc. and they shall be subject to Employer's approval.
	(12)	The chiller system shall be provided with 100% redundant chilled water pumps with suction and discharge pressure gauges and temperature gauges; Chilled water circulation pump with 100% standby facility; Storage tank automatic water make up with manual by-pass facility, temperature indicator, level gauge and drain and overflow connection, in addition to any other instruments/equipments required for smooth, convenient operation of the system, which shall also be furnished by the Contractor.
	(13).	One set of redundant power supply (from different Units) with auto changeover facility mounted inside PDB shall be provided by Contractor for chiller.
2.11.00	The Steam and Water Analysis system shall be provided with the sample shut off valves, blow down valves, solenoid actuated valves, pressure reducer valves, safety relief valves, back pressure regulating valves, high pressure reducing valves etc. The requirements of the important valves are specified as under:	
	(1)	The sample shut off valves (globe type), blow down valves and automatic pressure reducer valves (all conforming to ASTM B16.34) shall be suitable for at least 1.25 times of maximum operating pressure and temperature of sample line.
	(2)	The back pressure regulating valve shall be globe type and shall be suitable for a pressure range of 0-50psi. The back pressure regulating valve shall consist of a range spring and a diaphragm assembly. The back pressure of the regulating valve is adjusted to the required set point by the range spring. In case of any excess pressure the diaphragm shall be lifted to release the excess pressure to maintain back pressure equal to the set value. Stainless steel trim with linear flow characteristics shall be provided
2.12.00	Bidder shall submit the data sheet of these valves and these shall be subject to Employer's approval during detailed engineering stage.	
	Gauges	
	i)	All temperature, pressure and level gauges are as per manufacturer's standard and proven practice.
2.13.00	ii)	Each gauge shall have a dial engraving or separate phenolic name plate to identify the service. Service engravings, make, model, ranges and other technical features shall be subject to Employer's approval. Gauges shall be located on the front of sample conditioning panel.
	iii)	Accuracy of measurement shall be ± 1% of full scale or better.
	Switches	
2.14.00	i)	Two (2) flow switches shall be provided, one on the primary cooling water outlet and one on the chilled water outlet. Accuracy/repeatability shall be ±2%. Make & model of flow switches shall be of Employer's approved one.
	ii)	Temperature switches shall be provided on the sample lines at primary sample outlet. All switches shall be repeatable within ±1.0% of full scale range.
2.15.00	Sample Patch Board	
	A quick disconnect patch board area shall be furnished on the SWAS panel. The patch board shall allow sample to be routed to any analyzer through quick disconnect valve at patch	
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		board on the sample conditioning panel. The area shall consist of a patch board with bulk head tube fittings with double end shut-off and hose inserts. Body protector plugs shall be provided for each bulkhead tube fittings. Number of hose inserts, disconnect fittings etc. shall be as shown in SWAS Diagram and other specification documents. The plugs shall be of type 316 SS construction. Sufficient length of 6mm ID, 9.5mm OD Tygon tubing shall be provided for complete spanning of the patch board area for interconnection of the bulkhead tube fittings. Each connection shall be provided with a Phenolic name plate engraved with a legend acceptable to the Employer.																										
2.14.00		Grab Samples Grab sample valves on the front of SWAS panel shall be provided to direct grab samples to trough through grab sample nozzles or to the drain header. Approximately 300mm of flexible Tygon tubing shall be provided for each sample to allow grab sample collection and prevent splashing. Grab sample nozzles shall be provided with adapter and panel mounting flanges. All these items i.e. nozzles, adapter and flanges shall be of Employer approved make.																										
2.15.00		Sample Sink A continuous sink, located at the place of grab sample analysis, shall be provided. The sink shall be of 316 stainless steel, 14 gage minimum. The sample sink shall be connected to waste drain header. Sample sink shall contain an integral stainless steel ledge to accommodate sample container. DM water connection shall be provided for cleaning of sample containers.																										
3.00.00		SPECIFICATION OF ANALYSERS																										
3.01.00		Field proven microprocessor based monitors/analyzers with LCD display and with necessary fault diagnostic features shall be employed. All analysers shall provide 4-20mA output signal capable of driving a load impedance of 500 Ohms minimum. The type, size, capacity, material, make, model and other specification details of the rest of the SWAS system like coolers, gauges/switches, sample pipes, filter, pressure reducing elements, grab sampling arrangement, valves & fittings, panels etc. shall be as decided during detailed engineering stage and shall be subject to Employer's approval. The power supply to all the analysers/monitors shall be supplied by Contractor from his UPS system with all necessary switches, fuses, wiring/cabling and other required accessories etc. for distribution to individual requirements. <table><tr><th colspan="7">Minimum specifications of analysers</th></tr><tr><th>Requirement s</th><th>Conductivity</th><th>PH</th><th>Phosphate</th><th>Chloride</th><th>Turbidity</th><th>Degassed Cation Conductivity</th></tr><tr><td>Type</td><td>For Hotwell, Two removable Type of Cells, For Others, Continuous Flow Through Type</td><td>Cell Flow Through sample pH analyser with Digital pH sensor. Digital pH sensor shall be suitably selected based on the conductivity range of respective process sample.</td><td>Colorimetric</td><td>Continuous Flow Through Type with Chloride & Sulphate Responsive Electrodes</td><td>Light reflection principle</td><td>Continuous Flow Through Type for continuous measurement of Specific conductivity, cation conductivity and degassed conductivity values</td></tr></table>						Minimum specifications of analysers							Requirement s	Conductivity	PH	Phosphate	Chloride	Turbidity	Degassed Cation Conductivity	Type	For Hotwell, Two removable Type of Cells, For Others, Continuous Flow Through Type	Cell Flow Through sample pH analyser with Digital pH sensor. Digital pH sensor shall be suitably selected based on the conductivity range of respective process sample.	Colorimetric	Continuous Flow Through Type with Chloride & Sulphate Responsive Electrodes	Light reflection principle	Continuous Flow Through Type for continuous measurement of Specific conductivity, cation conductivity and degassed conductivity values
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KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - IIIC-13 SWAS		PAGE 5 OF 8																						

CLAUSE NO.		 TECHNICAL REQUIREMENTS 					
	Accuracy	≤ ± 1%	≤ ± 1%	≤ ± 5% of reading	≤ ± 5%	≤ 2% for range 0-50 NTU, ≤ 5% for range 50 – 200 NTU	≤ ± 1% of Reading
	Response Time (90 % of Full Scale)	≤ 5 sec.		≤ 16 min.		≤ 5 min.	≤ 5 sec.
	Range*	0-1, 0-10, 0-100 micro-mho/cm (freely programmable) for Specific Conductivity 0-1 micro-mho/cm log scale for Cation conductivity	6-11 pH freely programmable	0-10 ppm freely programmable	0-1000 ppb freely programmable	0 – 100, 0- 200 MTU, programmable	0-1, 0-10, 0-100 μS/cm,(freely programmable)
	Temperature Compensation	Automatic/	Automatic	Automatic	Automatic		Automatic
	Sample Flow			50-150 ml/min			200ml/min (max)
	No. of Streams	Single	Single	Single	Single	Single	Single
	Analog output	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS		Separate 4-20mA outputs for transmitting Specific conductivity, Cation conductivity and Degassed Cation Conductivity values to DDCMIS.
	Minimum specifications of analyserscontinued						
	Requirements	Hydrazine	Silica	Sodium	Dissolved O2	Total Iron (Fe)	
	Type	Automatic Continuous Electrochemical Type	Continuous Colorimetric Type	Continuous Flow Through sample	Continuous Flow Through sample DO analyser with optical DO sensor	Continuous Flow Through sample	
Accuracy	≤ ± 5%	≤ ± 5% of reading	≤ ± 10% of reading	≤ ± 5% of reading	<±5 % of reading or ±0.005 ppm		
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371			SUB-SECTION - IIIC-13 SWAS		PAGE 6 OF 8

CLAUSE NO.		 TECHNICAL REQUIREMENTS 					
3.02.00	Response Time (90 % of Full Scale)	≤ 3 min.	≤ 15 min. (including sample switching)	≤ 4 min.	≤ 30 sec.	≤ 15 min. (including sample switching)	
	Stability	Calibration Once in a Month		Calibration Once in a Month			
	Range*	0-50, 0-100 ppb freely programmable	0-50, 0-100 ,0-500 ppb freely programmable	0-1,0-10, 0-100 ppb freely programmable	0-20,0-200 ppb freely programmable	0-50ppb, 0-150ppb, 0-300ppb, 0-1ppm, 0-5ppm freely programmable or as per the process requirement.	
	No. of Streams	Single	Multi stream with sequencer/ stream selector (min. 4 streams)	Multi stream with sequencer/ stream selector (min. 4 streams)	Single	Multi stream with sequencer/ stream selector (min. 4streams)	
	Temperature Compensation	Automatic	Automatic	Automatic	Automatic	Automatic	
	Sample Flow	170 ml/min (max)	50-150 ml/min	125 ml/min (max)	170 ml/min (max)	200ml/min (max)	
	Analog output	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	4-20 mA output to DDCMIS	
	REMARKS	All the analysers/cells shall have open Corrosion resistant drain to waste header.					
		The material of flow cell for all analysers shall be SS316.					
		Analysers/ monitors/ cells shall be suitable for operating under the conditions specified. Cell life of the sensor shall be mentioned in the datasheet.					
		Dual cation exchange column shall be provided for cation conductivity.					
		For Hot well conductivity measurement, the Contractor shall provide direct insertion / withdrawal type conductivity cell whereas for all other samples it shall be flow-through type. Monitors for hot well conductivity shall be suitable for field mounting.					
		Sequencer shall following minimum features: a. Sequencer shall be able to identify the sample line and display the current sample line going to analyser with description/channel number. b. There shall be complete handshaking between Analyser and Sequencer. Sequencer shall be able to identify non-availability of sample or choking etc. these conditions shall be alarmed to DDCMIS. There shall direct two way communication between Sequencer and DDCMIS for sample selection and bypassing of sample.					
		* The range selected for the analyser of all samples shall be as per process requirement and same shall be vetted by OEM/QSGM /QSTGM. Contractor to provide a document indicating selected ranges for each analyser.					
Contractor to furnish the open chemistry for all the analyser reagents being supplied under this package. Constitution of chemicals along with percentage of chemicals so that							
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - IIIC-13 SWAS		PAGE 7 OF 8

CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
	preparation / formulation can be done and checked at site LAB. Contractor to also provide the procedure for testing of reagents and shelf life of the chemicals. All the reagents shall be supplied as separate BBU items.		
3.03.00	Contractor to provide piping arrangement in Wet Panel with remote operated (From Unit-DDCMIS) three way isolating valve (solenoid operated) for manual rinsing of all the Cation columns with DM water during non-availability of main sample and during shut down condition. Tapping for DM water shall be taken from discharge of Make-up water pump. Necessary piping, valves, instruments for monitoring of DM water flow shall be in the scope of contractor.		
4.00.00	SAMPLE PIPING SYSTEM		
4.01.00	This shall include piping, fittings, valves and accessories from tapping point upto wet panel located in SWAS room on as required basis. All sample piping from source tapping to primary rack and primary rack to wet panel shall be sized to maintain the sample velocity and flow rate required by analysers including grab sample and fouling factor requirement for that sample line. All the sample piping shall be of seamless type of material ASTM A312 316 H, conforming to ANSI B36.19. The pipe schedule number shall be suitable for the particular application/sample parameters. Contractor to provide calculation for sizing of sample lines during detail Engineering and certify that the same is adequate for the intended purpose.		
4.02.00	Contractor to also provide automatic pressure reducer downstream of Primary coolers in each sample piping to ensure constant flow in each pipe in all regime of operation of Unit (from 0MW to rated MW).		
4.03.00	All fittings from source tapping to thermal shut-off valve and automatic pressure reducer shall be socket welding type and of material ASTM A182 F316H conforming to ANSI B 16.11. Rest of the sample pipeline fitting after Pressure and temperature reduction shall as double compression type or socket weld type as per contractor standard proven practice.		
4.04.00	Single and multi-pipes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy check up and for proper connections.		
4.05.00	The valves to be used in sample piping shall be of stainless steel conforming to ASTM A182/312. The pressure temperature ratings shall be as per ANSI B16.34. The valve design shall be such that the seats can be reconditioned and stem and disc can be replaced without removing valve body from the line. The specification of End size, Pressure class, Type, End preparation, Body, etc. for different type of valves are specified in SWAS table in Clause No. 4.06.00 of Subsection IIIC-09, Section-VI, Part-B.		
5.00.00	Contract quantities Refer Appendix- I to part A, Section VI of technical specifications.		
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371 SUB-SECTION - IIIC-13 SWAS PAGE 8 OF 8			

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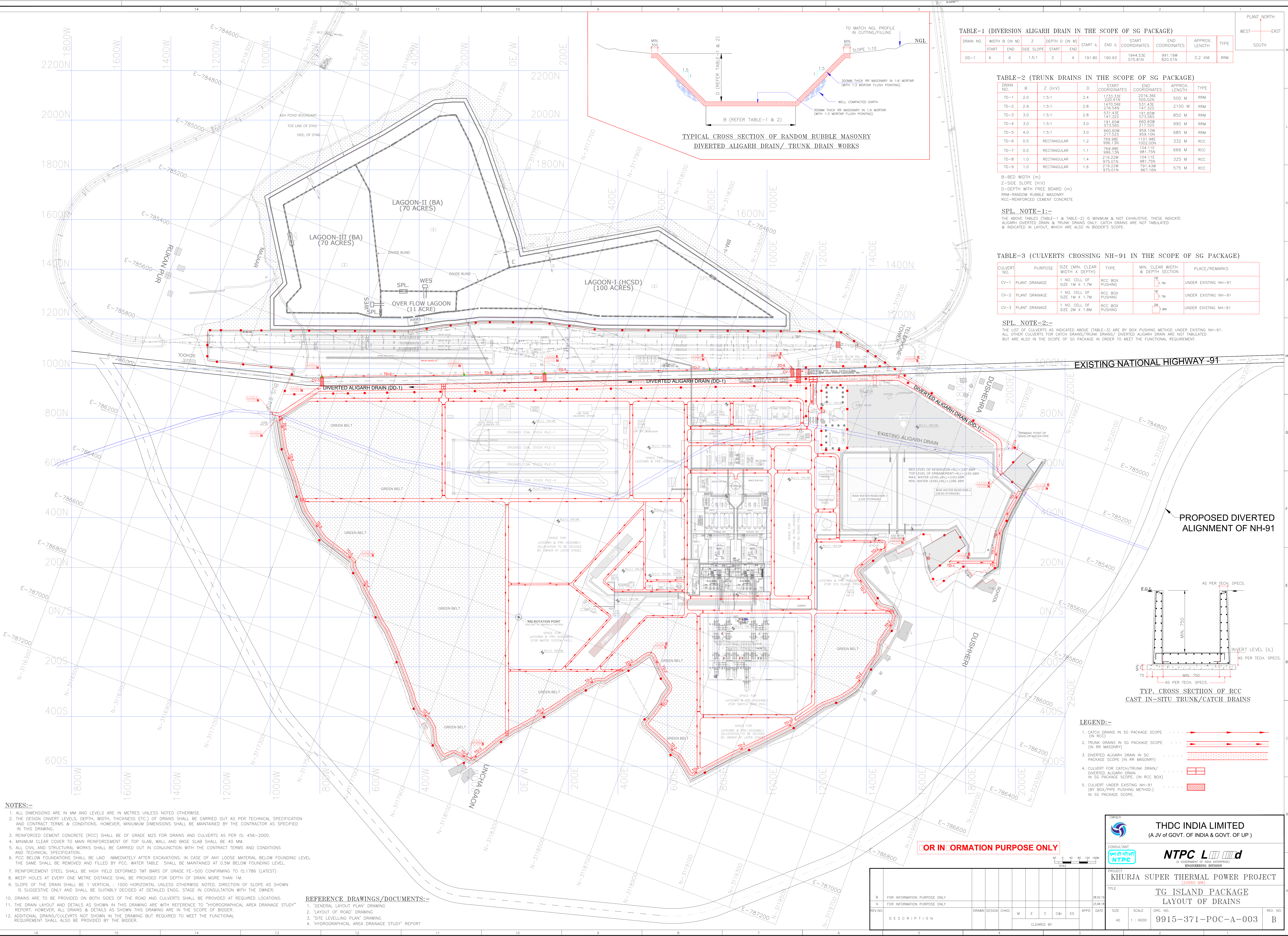


TABLE-1 (DIVERSION ALIGARH DRAIN IN THE SCOPE OF SG PACKAGE)

DRAIN NO.	WIDTH B (IN M)		Z	DEPTH D (IN M)		START IL	END IL	START COORDINATES	END COORDINATES	APPROX. LENGTH	TYPE
	START	END		START	END						
DD-1	6	6	1.5:1	3	4	191.80	190.83	1944.53E 975.81N	991.19W 820.01N	3.2 KM	RRM

TABLE-2 (TRUNK DRAINS IN THE SCOPE OF SG PACKAGE)

DRAIN NO.	B	Z (H/V)	D	START COORDINATES	END COORDINATES	APPROX. LENGTH	TYPE
TD-1	2.0	1.5:1	2.4	1733.33E 220.41N	2016.34E 505.02N	500 M	RRM
TD-2	2.9	1.5:1	2.8	1740.00E 276.54N	2311.43E 147.32S	2100 M	RRM
TD-3	3.0	1.5:1	2.8	533.43E 143.32S	191.65W 975.81N	850 M	RRM
TD-4	3.0	1.5:1	3.0	191.65W 975.81N	660.60W 217.52S	990 M	RRM
TD-5	4.0	1.5:1	3.0	660.60W 217.52S	959.10W 959.10N	685 M	RRM
TD-6	0.5	RECTANGULAR	1.2	769.98E 996.13N	101.88E 1002.00N	332 M	RCC
TD-7	0.5	RECTANGULAR	1.1	769.98E 996.13N	104.11E 981.75N	666 M	RCC
TD-8	1.0	RECTANGULAR	1.4	219.22W 975.01N	104.11E 981.75N	325 M	RCC
TD-9	1.0	RECTANGULAR	1.6	219.22W 975.01N	791.43W 967.16N	575 M	RCC

B-BED WIDTH (m)
Z-SIDE SLOPE (H/V)
D-DEPTH WITH FREE BOARD (m)
RRM-RANDOM RUBBLE MASONRY
RCC-REINFORCED CEMENT CONCRETE

SPL. NOTE-1:-

THE ABOVE TABLES (TABLE-1 & TABLE-2) IS MINIMUM & NOT EXHAUSTIVE. THESE INDICATE ALIGARH DIVERTED DRAIN & TRUNK DRAINS ONLY. CATCH DRAINS ARE NOT TABULATED & INDICATED IN LAYOUT, WHICH ARE ALSO IN BIDDER'S SCOPE.

TABLE-3 (CULVERTS CROSSING NH-91 IN THE SCOPE OF SG PACKAGE)

CULVERT NO.	PURPOSE	SIZE (MIN. CLEAR WIDTH X DEPTH)	TYPE	MIN. CLEAR WIDTH & DEPTH SECTION	PLACE/REMARKS
CV-1	PLANT DRAINAGE	1 NO. CELL OF SIZE 1M X 1.7M	RCC BOX PUSHING	1M 1.7M	UNDER EXISTING NH-91
CV-2	PLANT DRAINAGE	1 NO. CELL OF SIZE 1M X 1.7M	RCC BOX PUSHING	1M 1.7M	UNDER EXISTING NH-91
CV-3	PLANT DRAINAGE	1 NO. CELL OF SIZE 2M X 1.8M	RCC BOX PUSHING	2M 1.8M	UNDER EXISTING NH-91

SPL. NOTE-2:-

THE LIST OF CULVERTS AS INDICATED ABOVE (TABLE-3) ARE BY BOX PUSHING METHOD UNDER EXISTING NH-91. ALL OTHER CULVERTS FOR CATCH DRAINS/TRUNK DRAINS/ DIVERTED ALIGARH DRAIN ARE NOT TABULATED BUT ARE ALSO IN THE SCOPE OF SG PACKAGE IN ORDER TO MEET THE FUNCTIONAL REQUIREMENT.

NOTES:-

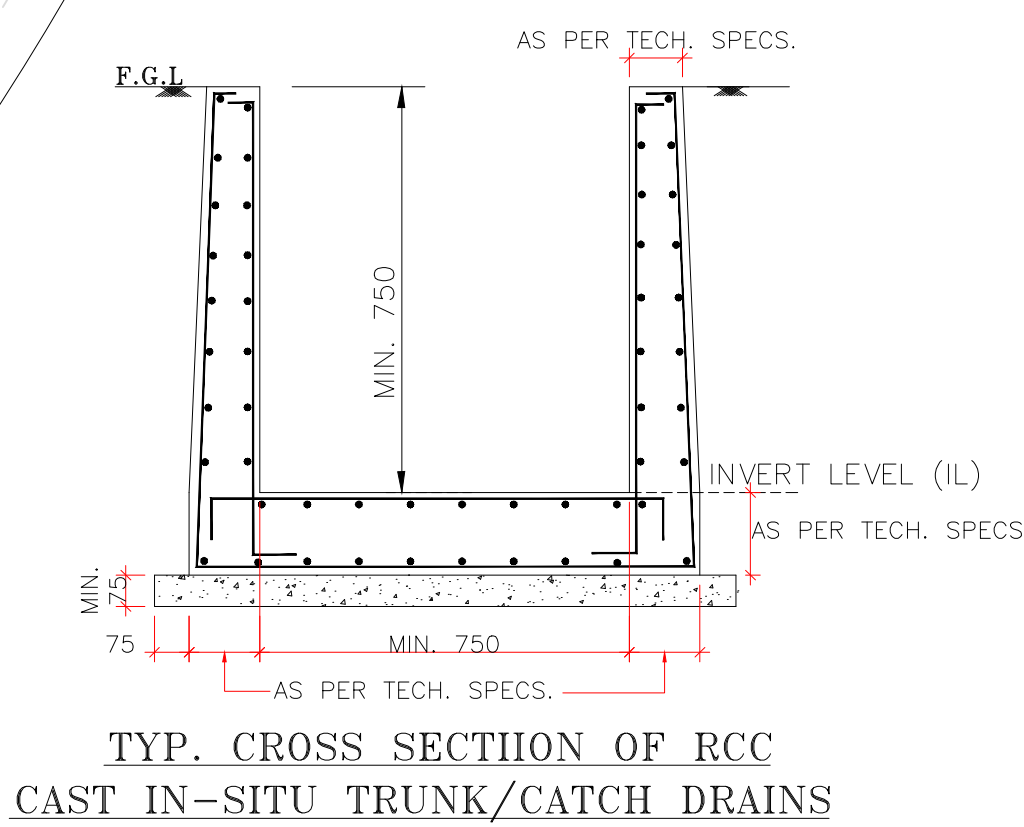
- ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
- THE DESIGN (INVERT LEVELS, DEPTH, WIDTH, THICKNESS ETC.) OF DRAINS SHALL BE CARRIED OUT AS PER TECHNICAL SPECIFICATION AND CONTRACT TERMS & CONDITIONS. HOWEVER, MINIMUM DIMENSIONS SHALL BE MAINTAINED BY THE CONTRACTOR AS SPECIFIED IN THIS DRAWING.
- REINFORCED CEMENT CONCRETE (RCC) SHALL BE OF GRADE M25 FOR DRAINS AND CULVERTS AS PER IS: 456-2000.
- MINIMUM CLEAR COVER TO MAIN REINFORCEMENT OF TOP SLAB, WALL AND BASE SLAB SHALL BE 40 MM.
- ALL CIVIL AND STRUCTURAL WORKS SHALL BE CARRIED OUT IN CONJUNCTION WITH THE CONTRACT TERMS AND CONDITIONS AND TECHNICAL SPECIFICATION.
- PCC BELOW FOUNDATIONS SHALL BE LAID IMMEDIATELY AFTER EXCAVATIONS. IN CASE OF ANY LOOSE MATERIAL BELOW FOUNDING LEVEL THE SAME SHALL BE REMOVED AND FILLED BY PCC. WATER TABLE SHALL BE MAINTAINED AT 0.5M BELOW FOUNDING LEVEL.
- REINFORCEMENT STEEL SHALL BE HIGH YIELD DEFORMED TMT BARS OF GRADE FE-500 CONFORMING TO IS:1786 (LATEST)
- WEEP HOLES AT EVERY ONE METRE DISTANCE SHALL BE PROVIDED FOR DEPTH OF DRAIN MORE THAN 1M.
- SLOPE OF THE DRAIN SHALL BE 1 VERTICAL : 1000 HORIZONTAL UNLESS OTHERWISE NOTED. DIRECTION OF SLOPE AS SHOWN IS SUGGESTIVE ONLY AND SHALL BE SUITABLY DECIDED AT DETAILED ENGG. STAGE IN CONSULTATION WITH THE OWNER.
- DRAINS ARE TO BE PROVIDED ON BOTH SIDES OF THE ROAD AND CULVERTS SHALL BE PROVIDED AT REQUIRED LOCATIONS.
- THE DRAIN LAYOUT AND DETAILS AS SHOWN IN THIS DRAWING ARE WITH REFERENCE TO "HYDROGRAPHICAL AREA DRAINAGE STUDY" REPORT. HOWEVER, ALL DRAINS & DETAILS AS SHOWN IN THIS DRAWING ARE IN THE SCOPE OF BIDDER.
- ADDITIONAL DRAINS/CULVERTS NOT SHOWN IN THE DRAWING BUT REQUIRED TO MEET THE FUNCTIONAL REQUIREMENT SHALL ALSO BE PROVIDED BY THE BIDDER.

REFERENCE DRAWINGS/DOCUMENTS:-

- "GENERAL LAYOUT PLAN" DRAWING
- "LAYOUT OF ROAD" DRAWING
- "SITE LEVELLING PLAN" DRAWING
- "HYDROGRAPHICAL AREA DRAINAGE STUDY" REPORT

LEGEND:-

- CATCH DRAINS IN SG PACKAGE SCOPE (IN RCC)
- TRUNK DRAINS IN SG PACKAGE SCOPE (IN RR MASONRY)
- DIVERTED ALIGARH DRAIN IN SG PACKAGE SCOPE (IN RR MASONRY)
- CULVERT FOR CATCH/TRUNK DRAIN/ DIVERTED ALIGARH DRAIN IN SG PACKAGE SCOPE (IN RCC BOX)
- CULVERT UNDER EXISTING NH-91 (BY BOX/PIPE PUSHING METHOD) IN SG PACKAGE SCOPE.



TYP. CROSS SECTION OF RCC CAST IN-SITU TRUNK/CATCH DRAINS

OR IN FORMATION PURPOSE ONLY

**OWNER**
THDC INDIA LIMITED
(A JV OF GOVT. OF INDIA & GOVT. OF UP)

**CONSULTANT**
NTPC Ltd
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT
KHURJA SUPER THERMAL POWER PROJECT
(2x660 MW)

TITLE
TG ISLAND PACKAGE
LAYOUT OF DRAINS

REV. NO.
B

REV. NO.

DESCRIPTION

DATE

28.03.19

APPD.

DATE

28.03.19

28.03.19

DESIGNED BY

M. E. C. C&I. ES.

CHECKED BY

M. E. C. C&I. ES.

DATE

28.03.19

SCALE

1 : 6000

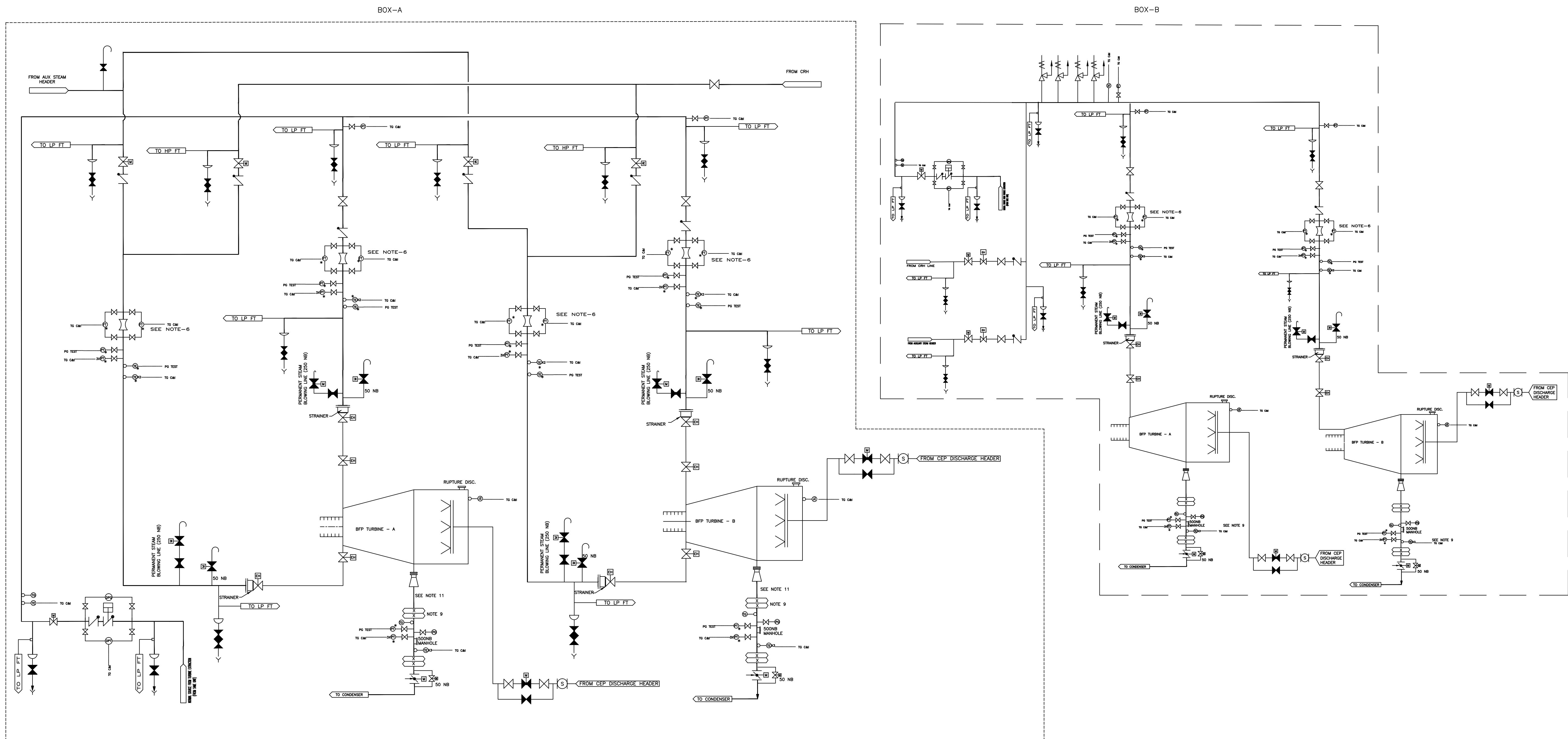
DRG. NO.

9915-371-POC-A-003

REV. NO.

B

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NOTE:

1. TWO TYPE OF ARRANGEMENT HAS BEEN SHOWN IN BOX-A AND B FOR EXTRACTION STEAM SYSTEM TO BFP. BOTH OF THE ARRANGEMENTS ARE ACCEPTABLE IF IT IS THE STANDARD AND PROVEN PRACTICE OF THE BIDDER.
2. PIPING AND EQUIPMENT DRAINS SHOWN ARE INDICATIVE REQUIREMENT SHALL BE FINALISED BASED ON PROCESS/LAYOUT AS WELL AS ASME TDP REQUIREMENTS.
3. ALSO REFER DRG: MAIN STEAM, HOT REHEAT AND COLD REHEAT P&ID
4. IN CASE RELIEF DIAPHRAGM IS PROVIDED ON EXHAUST PIPE, THEN THE VENT PIPING INCLUDING HANGERS, SUPPORTS TO VENT THE STEAM RELEASED DUE TO RUPTURE OF RELIEF DIAPHRAGM SHALL BE Laid SUITABLY OUTSIDE THE TURBINE HALL BY THE BIDDER.
5. PROPER TURBINE DRIVE GLAND SEALING ARRANGEMENT COMPLETE WITH VALVES, PIPING, FITTINGS ETC. SHALL BE PROVIDED BY BIDDER EITHER FROM MAIN TO GLAND SEALING HEADER OR ANY STEAM HEADER AS PER THEIR STANDARD PRACTICE.
6. IN CASE OF SINGLE ADMISSION BFP TURBINE, A SINGLE FLOW MEASURING ELEMENT MAY BE PROVIDED FOR MEASURING STEAM FLOW.
7. AT ALL EQUIPMENT/VALVES/SPECIALITIES TO PIPING INTERFACE POINTS MATCHING COUNTER FLANGES, WHEREVER REQUIRED, SHALL BE PROVIDED BY THE EQUIPMENT/VALVES/SPECIALITIES SUPPLIER.
8. BIDDER SHALL PROVIDE STUBS & TAPPING FOR PG TEST OF EQUIPMENT/SYSTEM UNDER HIS SCOPE OF SUPPLY AND FOR SAMPLING WHEREVER REQUIRED.
9. NO. AND LOCATION OF METALLIC EXPANSION JOINTS SHALL BE BASED ON STRESS ANALYSIS.
10. FOR DETAILS OF IMPULSE/ROOT VALVES ETC. REFER C&I INSTALLATION/SOURCE CONNECTION DRAWING NOs: 0000-999-POI-A-022 TO 0000-999-POI-A-035 FOR SG ISLAND PACKAGE AND DRAWING NOs: 0000-110-POI-A-022 TO 0000-110-POI-A-035 FOR STG ISLAND PACKAGE.
11. THE BIDDER MAY OFFER SEPARATE CONDENSER FOR EACH BFP DRIVE TURBINE, IN WHICH CASE, THE ITEMS SHOWN ON THE EXHAUST LINE WILL NOT BE APPLICABLE.
12. FOR KKS CODES, REFER DRWG. NO 0000-110-POI-G-001
13. VENTURI TYPE OF FLOW ELEMENT IS SHOWN HERE, HOWEVER BIDDER MAY OFFER NOZZLE TYPE OF FLOW ELEMENT BASED ON HIS STANDARD PRACTICE OR AS PER THE RANGE OF REYNOLDS NO AS MENTIONED IN ISO-5167.
14. BOP-C&I MAY BE READ AS BOP-C&I-TG.
15. THE SPECIFICATION OF INSTRUMENTS WITH * MARK SHALL BE IDENTICAL (I.E. SAME ACCURACY) AND ACCURACY LEVEL OF THESE INSTRUMENTS SHALL CONFORM TO ASME PTC REQUIREMENTS FOR PG TEST. IT SHALL BE ENSURED THAT ALL THESE INSTRUMENTS ARE NECESSARILY SUPPLIED AND ERECTED AT THE SAME TIME SO AS TO FACILITATE CONDUCTANCE OF PG TEST DURING INITIAL OPERATION.
16. INSTRUMENTS WHICH ARE SHOWN AS CONNECTED TO PG TEST SHALL BE USED FOR PG TEST AND SHALL BE PERMANENTLY INSTALLED IN THE PIPING AND KEPT WIRED UP TO THE PG TEST DATA LOGGER/ PG TEST CALCULATION SERVER (INDICATED IN FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES) EVEN AFTER CONDUCTANCE OF THE PG TEST & SHALL BE THE PROPERTY OF NTPC. INSTRUMENTS SHOWN FOR PG TEST ARE MINIMUM IN NUMBER. IN CASE ADDITIONAL INSTRUMENTS OVER AND ABOVE THOSE INDICATED HERE AS CONNECTED TO PG TEST ARE REQUIRED BY CONTRACTOR FOR CONDUCTANCE OF PG TEST, THEN THE SAME SHALL BE SUPPLIED WITHIN THIS CONTRACT WITH SPECIFICATION CONFORMING TO ASME PTC REQUIREMENTS.

FOR TENDER PURPOSE ONLY

OWNER
THDC INDIA LIMITED
(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT
NTPC Ltd.
(A Government of India Enterprise)
ENGINEERING DIVISION

PROJECT
KHURJA SUPER THERMAL POWER PROJECT (STAGE-I)
(2X660 MW)

TITLE
EXTRACTION STEAM P&ID FOR BFP TURBINE

SIZE	SCALE	DRG. NO.	REV. NO.
A-1	NTS	9915-999-POM-A-008	C

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	C&I	APPD.	DATE
A	RELEASED FOR TENDER	AS	HAS	HAS			AKK	22/02/19
					CLEARED BY			

THDC INDIA LIMITED

(A Joint Venture of Govt. of India & Govt. of U.P.)
Pragati Bhawan, Pragatipuram, Bypass Road, Rishikesh
UTTARAKHAND, INDIA



Amendment No.15

dated 26th Mar'2019
to

**Turbine Generator and Associated Packages for Khurja Super
Thermal Power Project (2x660 MW)**

AMENDMENT NO. THDC/RKSH/CC-9915-371-AMDT-15

Tender No. THDC/RKSH/CC-9915-371

Amendment No. 15 to Bidding Documents [Commercial (Section I, II, III, IV, V & VII)]

Sl. No.	Ref. Clause	Existing Provisions	Amended provisions
1.	Item No. 4.2, Section-III (BDS)	The reference plants whose details have been declared as per the specified format in the relevant attachment [i.e. Attachment No.-3A] shall only be considered to ascertain the bidder's compliance to the specified Qualifying Requirement (QR). Bidders wishing to provide additional reference plants are required to declare the same in similar format which shall be additionally attached. However, bidders are not permitted to quote more than three times of the reference works/plants wherever specified in the Qualifying Requirements for this purpose. Bidders are required to furnish the details of past experience based on which selection is to be made as per format enclosed in the bidding documents and enclose relevant documents like copies of authentic work order, completion certificate, agreements etc. supporting the details/data provided in the format. No claims without supporting documents shall be accepted in this regard. The Employer at its discretion may seek any clarification and/or documentary evidence only for the reference plants as mentioned above. However, no change or substitution of the reference plants as new/additional plant for conforming to the specified Qualifying Requirement shall be sought, offered or permitted.	The reference plants whose details have been declared as per the specified format in the relevant attachment [i.e. Attachment No.-3A] shall only be considered to ascertain the bidder's compliance to the specified Qualifying Requirement (QR). Bidders wishing to provide additional reference plants are required to declare the same in similar format which shall be additionally attached. However, bidders are not permitted to quote more than three times of the reference works/plants wherever specified in the Qualifying Requirements for this purpose. Bidders are required to furnish the details of past experience based on which selection is to be made as per format enclosed in the bidding documents and enclose relevant documents like copies of authentic work order, completion certificate, agreements etc. supporting the details/data provided in the format. No claims without supporting documents shall be accepted in this regard. <i>However, if any of the reference work pertains to the Contract(s)/Works executed by Bidder for NTPC in the past then in respect of such Contract(s)/Works Bidder shall not be required to enclose Client Certificate(s) alongwith its bid.</i> The Employer at its discretion may seek any clarification and/or documentary evidence only for the reference plants as mentioned above. However, no change or substitution of the reference plants as new/additional plant for conforming to the specified Qualifying Requirement shall be sought, offered or permitted.

Package: Turbine Generator And Associated Packages

Project: Khurja Super Thermal Power Project (2 X 660 MW)

Doc. No: THDC/RKSH/CC-9915-371-AMDT.15

Page 1 of 1

AMENDMENT NO.16 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

SL. NO.	SPECIFICATION REFERENCE				Existing	Read as
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
1	VI/ B	A-02	1	1.01.02 (c)	Face of the buildings and facilities shall be located in such a way so as to have an offset of minimum 20 m with respect to centre line of double lane road and 15 meter with respect to centre line of single lane road. The spacing between various buildings and facilities shall be suitably decided so as to avoid interference between the foundations.	Face of the buildings and facilities shall be located in such a way so as to have an offset of minimum 15 m with respect to centre line of double lane road and 12 m with respect to centre line of single lane road. The spacing between various buildings and facilities shall be suitably decided so as to avoid interference between the foundations.
2	VI/B	A-2	5 OF 12	1.02.00.3	'Following clear Height shall be considered while developing the layout of HT/LT Switchgear Room and Boiler MCC room. i) With Bus Duct – 4.5 m (min) ii) Without Bus Duct – 4.0 m (min)	'Following Height shall be considered while developing the layout of HT/LT Switchgear Room and Boiler MCC room. i) With Bus Duct – 4.5 m (min) ii) Without Bus Duct – 4.0 m (min)

Amendment No. 19 to Bidding Documents [Commercial (Section I, II, III, IV, V & VII)]

Sl. No.	Ref. Clause	Existing Provisions	Amended provisions																
1.	Clause 8.2.2.1 (viii), Section-II (ITB)	Attachment 10 (P) :- Deleted	Attachment 10(P) :- Declaration on Local Content Declaration regarding local content as per the Employer's format, for granting of purchase preference. In case a bidder does not submit the aforesaid declaration or no value is indicated by the bidder or statement/any declaration like 'later', 'to be furnished later', 'NA' etc. are indicated by the bidder, then the bidder shall not be considered as a local supplier and shall not be eligible for any purchase preference. No further claim in this regard shall be entertained by the Employer.																
2.	Clause 8.2.2.1 (xii), Section-II (ITB)	New clause	Attachment 9 (Rev.01): Erection Tools and Plant and Safety Equipments & Safety Personal Protective Equipments List of Erection Tools and Plant and Safety Equipments & Safety Personal Protective Equipments which the bidder proposes to bring to site in case the contract is awarded to him.																
3.	ITB Clause no. 30.1	Subject to ITB Clause 31, the Employer will award the contract to the successful Bidder whose bid has been determined to be substantially responsive and to be the lowest evaluated bid, further provided that the Bidder is determined to be qualified to perform the contract satisfactorily.	Subject to ITB Clause 31 (Employer's Right to Accept any Bid and to Reject any or all bids), the Employer will award the Contract to the Bidder, whose bid has been determined to be substantially responsive to the Bidding Documents and provided that such bidder has been determined to be qualified to perform the contract satisfactorily, as per methodology indicated in Annexure-II to BDS.																
4.	Item No. 9.1, Sl. No. 3.0, BDS (Section-III)	3.0 THDC Inputs: <table><tr><th>Sl. No.</th><th>Input</th><th colspan="2">Schedule (Month from NOA)</th></tr><tr><td></td><td></td><th>Unit #1</th><th>Unit #2</th></tr></table>	Sl. No.	Input	Schedule (Month from NOA)				Unit #1	Unit #2	3.0 THDC Inputs: <table><tr><th>Sl. No.</th><th>Input</th><th colspan="2">Schedule (Month from NOA)</th></tr><tr><td></td><td></td><th>Unit #1</th><th>Unit #2</th></tr></table>	Sl. No.	Input	Schedule (Month from NOA)				Unit #1	Unit #2
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Package: Turbine Generator And Associated Packages

Project: Khurja Super Thermal Power Project (2 X 660 MW)

Doc. No: THDC/RKSH/CC-9915-371-AMDT.19

Amendment No. 19 to Bidding Documents [Commercial (Section I, II, III, IV, V & VII)]

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Package: Turbine Generator And Associated Packages

Project: Khurja Super Thermal Power Project (2 X 660 MW)

Doc. No: THDC/RKSH/CC-9915-371-AMDT.19

Amendment No. 19 to Bidding Documents [Commercial (Section I, II, III, IV, V & VII)]

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7.	BID FORM STAGE-II (PRICE) BID Section-VII, Book 2 of 3	Existing Bid Form Stage-II (Price) Bid	Replace the existing Bid Form Stage-II (Price) Bid with the revised Bid Form Stage-II (Price) Bid (Rev.01) which is enclosed herewith.																																				
8.	Clause 55 (GCC cl. 6.5), Section-V (SCC)	GCC Clause 6.5	GCC clause 6.5 stands deleted.																																				

Package: Turbine Generator And Associated Packages

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Doc. No: THDC/RKSH/CC-9915-371-AMDT.19

Amendment No. 19 to Bidding Documents [Commercial (Section I, II, III, IV, V & VII)]

9.	Clause 39, Section-V (SCC)	-	SCC clause 39 stands deleted.
10.	Clause 62 (GCC clause30), Section-V (SCC)	New clause	62. Replace existing GCC 'Clause 30: Limitation of Liability' with the following: 30.1 Except in cases of criminal negligence or willful misconduct, (a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer and (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to any obligation of the Contractor to indemnify the Employer with respect to patent infringement. (c) the aggregate liability of the Employer to the Contractor except for GCC sub-clause 29.3, whether under the Contract, in tort or otherwise, at any point of time during the execution/performance of the Contract, shall not exceed the 'total Contract Price less payments already released to the Contractor'.

Package: Turbine Generator And Associated Packages

Project: Khurja Super Thermal Power Project (2 X 660 MW)

Doc. No: THDC/RKSH/CC-9915-371-AMDT.19

Page 4 of 5

Amendment No. 19 to Bidding Documents [Commercial (Section I, II, III, IV, V & VII)]

11.	Clause 63 (GCC clause 47), Section-V (SCC)	New GCC Clause	Clause no. 47 No Claim for interest or damage 47.1 Interest on money due to the contractor: No omission on the part of the Engineer-in-Charge to pay the amount due upon measurement or otherwise shall vitiate or make void the contract, nor shall the contractor be entitled to interest upon any guarantee or payments in arrears nor upon any balance which may on the final settlement of his account, be due to him. 47.2 No claim for interest or damage: No claim for interest or damage will be entertained or be payable by the Corporation in respect of any amount or balances which may be lying with the Corporation owing to any dispute, difference or misunderstanding between the parties or in respect of any delay or omission on the part of the Engineer--in-Charge in making intermediate or final payments or in any other respect whatsoever.
12.	Price Schedules, Section-VII, Part 2 of 3	Existing Price Schedules	Replace the existing Price Schedules with the revised Price Schedules which are enclosed.

**TURBINE GENERATOR AND ASSOCIATED PACKAGES
FOR
KHURJA SUPER THERMAL POWER PROJECT (2 X 660 MW)
BIDDING DOCUMENT NO. : THDC/RKSH/CC- 9915-371**

(DECLARATION ON LOCAL CONTENT)

Bidder's Name and Address :

To
Corporate Contracts,
THDC India Ltd.,
Pragati Bhawan, By-Pass Road,
Pragatipuram, Rishikesh - 249 201

Dear Sirs,

We have read the provisions of "Preference to Make In India and granting of purchase preference to local suppliers" enclosed with the Bid Data Sheets. In terms of the requirement of the aforesaid provisions, we hereby declare the following:

- 1.0 In order to avail purchase preference, we confirm that we are a Local Supplier, and the local content included in the package is% of our total bid price for complete scope of work for **Turbine Generator And Associated Packages** for Khurja Super Thermal Power Project (2x660 MW) as per details given below.

Sl. No.	Description of Goods & Services	Quantity/ Weight	Value of Local Goods & Services	% of Total bid Price	Details of the location(s) at which the local value addition is made

A certificate from the statutory auditor or cost auditor(in the case the bidder is a company)orfromapracticingcostaccountantorpracticingcharteredaccountant.

(in respect of bidders other than companies) giving the percentage of local content has been placed at Annexure-1 to this Attachment.

2.0 Further, we hereby confirm the following:

Whether the bidder is presently debarred / banned by any other procuring entity for violation of 'Public Procurement (Preference to Make In India), Order 2017' (PPP-MII Order) dated 15.06.2017 issued by Department of Industrial Policy and Promotion (DIPP)	Yes* / No*
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*** Strike off, whichever is not applicable**

3.0 We agree to furnish any information as a proof of the above to your satisfaction as and when required.

- Note : 1)** Continuation sheets of like size and format, may be used as per Bidder's requirement and shall be annexed to this Attachment.
- 2) Certificate pertaining to percentage of local content from statutory auditor or cost auditor / practicing chartered accountant or cost accountant is to be furnished in cases where the total bid price is more than INR 10 Crores.

**TURBINE GENERATOR AND ASSOCIATED PACKAGES
FOR
KHURJA SUPER THERMAL POWER PROJECT (2 X 660 MW)
BIDDING DOCUMENT NO. : THDC/RKSH/CC- 9915-371
(Schedule of Construction and Erection Tools & Tackles)**

Bidder's Name and Address :

To
Corporate Contracts,
THDC India Ltd.,
Pragati Bhawan, By-Pass Road,
Pragatipuram, Rishikesh - 249 201

Dear Sirs,

I. ERECTION TOOLS & EQUIPMENTS

We indicate herein below the minimum T & P we have in our/our associate's/subvender's possession and the equipment we propose to bring to the Site required for entire **Turbine Generator and Associated Packages**, in case the contract is awarded to us.

Sl. No.	Type and Description of the Equipment	Quantity of Suggestive major T&P to be deployed	Number the Bidder has in possession	Number the Bidder proposes to bring to the Site
(1)	(2)	(3)	(4)	(5)

We hereby confirm that the quantity and type of Certain tools and equipment, we will deploy for construction/erection, will not be less than those listed above (Col-5) and agree to bring more equipment, if so warranted, in the opinion of the Project Manager. Our proposed construction/erection equipment utilisation plan indicating utilisation dates and time duration of all major erection and construction equipment placed on site, is enclosed at Annexure..... to this Attachment-9.

We have enclosed construction and erection philosophy including sequence of erection and construction, implementation methodology, deployment schedule of tools and plant to be brought to site for construction/ erection work under the subject package with Attachment-14 of Our Techno-Commercial Bid, linked with major milestone and intermediate milestone for Turbine Generator and Associated Packages. We have also enclosed network showing inter-linkage between major milestones, tool and plants deployed and sequential supply of material for the subject package.

Note: Bidder's attention is drawn to the provision of BDS regarding deployment of T&Ps as per suggestive list of T&Ps for STG and Civil Works enclosed at Annexure-A & B to BDS, Section-III to Bidding Documents.

II. Safety Equipments& Safety Personal Protective Equipments

The list of minimum suggestive Safety Equipments& Safety Personal Protective Equipments to be deployed necessarily by the bidder is furnished below. However, the actual deployment at site shall not be limited to these and additional equipments if required shall be mobilised by the Contractor.

S No	Minimum Suggested List of Safety Equipments and Safety Personal Protective Equipments	Minimum Nos. required
1	Safety Net (Net Size: 10m x 5m, Mesh Size: 25 mm, Mesh Rope: 2mm double cord, Border/Tie Cord: 12mm diameter polypropylene rope (tested as per IS: 5175).Two metres length shall be provided at all four corners.	70
2	Fall Arrestor 'Rope grab fall arrestor' & anchorage line. Anchorage Line: 14mm-16 mm diameter, three strand twisted Polyamide rope. Rope Grab fall arrestor: Openable & Guided type Fall Arrestor (on flexible line) conforming EN 353-2 & works on 14-16 mm diameter polyamide rope. material: Nickel Chrome plated Steel Connector: Karbiner conforming to EN 362 (Minimum Strength 22 kN), material: Steel	50 nos. of Rope Grab Fall arrestor' and Karbiner each. 10 nos. anchorage line, 30 meter long each, 30 nos. anchorage line, 40 meter long each.
3	Horizontal life line Stainless Steel Wire rope of 8mm diameter. Minimum six nos. of steel U-bolt clips are required for clamping each wire rope to a rigid support (03 nos. of U-bolt clips at each end).	50 nos. of wire rope, each 25 meter long.
4	Ladders on column The minimum design live load on metallic ladder shall be a single concentrated load of 100 kilo grams. All rungs shall have a minimum diameter of 1.90 centimeters, and minimum clear length of rungs shall be 40.6 centimeters. The distance between rungs shall not exceed 30.5 centimeters. Each ladder shall have maximum height of 9.0 metre. The ladder shall have proper fastenings for attaching it to a column using positive means such as bolt, weld or other type of fasteners.	cumulative length of ladders is 300 meters
5	Safety PPEs (Industrial Safety helmet & Industrial Safety Shoes) Industrial Safety Helmet (IS:2925-1984 marked). Industrial Safety Shoes (IS:15298-2002 marked).	525 nos. each

Note:

1. Safety PPEs include Industrial Safety Helmet and Industrial Safety Shoes.

Date : (Signature)
Place : (Printed Name)
(Designation)
(Common Seal)

Sub: Preference to Make In India and granting of purchase preference to local suppliers- regarding

It is the policy of the Government of India to encourage 'Make in India' and promote manufacturing and production of Goods and Services in India with a view to enhancing income and employment. In this regard, the following guidelines, concerning the procedure to be adopted for granting purchase preference to local suppliers, are hereby issued:

1.0 Definitions:

- a) **'Local content'** means the amount of value added in India which shall be the total value of the goods and services procured (excluding net domestic indirect taxes) minus the value of imported content in the goods and services (including all customs duties) as a proportion of the total value, in percent.
- b) **'Local supplier'** means a supplier or service provider whose product or service offered for procurement meets the minimum local content as prescribed.
- c) **'L1'** means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.
- d) **'Margin of purchase preference'** means the maximum extent to which the evaluated bid price of a local supplier may be above the L1 for the purpose of purchase preference.
- e) **'Nodal Ministry'** means the Ministry or Department identified in respect of a particular item of goods or services or works

2.0 Minimum local content

- 2.1 The minimum local content shall be 60%.

3.0 Margin of Purchase Preference

- 3.1 The margin of purchase preference shall be 20%.

4.0 Requirement of Purchase Preference:

- 4.1 Purchase preference shall be given to local suppliers as specified here under:

The following procedure shall be followed:

- i) Among all qualified and substantially responsive bids, the lowest evaluated bid will be termed as L1. If L1 bid is from a local supplier, the contract will be awarded to L1.

- ii) If L1 bid is not from a local supplier, the lowest evaluated bidder among the local suppliers, will be invited to match the lowest evaluated bid (L1) price subject to local supplier's evaluated bid price falling within the margin of purchase preference and the contract shall be awarded to such local supplier subject to matching the lowest evaluated bid (L1) price.
- iii) In case such lowest eligible local supplier fails to match the lowest evaluated bid (L1) price, the local supplier with the next higher evaluated bid within the margin of purchase preference shall be invited to match the lowest evaluated bid (L1) price and so on and contract shall be awarded accordingly. In case none of the local suppliers within the margin of purchase preference matches the lowest evaluated bid (L1) price, then the contract may be awarded to the L1 bidder.
- iv) For the purpose of matching of lowest evaluated bid (L1) price, the local supplier would have to necessarily reduce all components of the quoted price on pro-rata basis. The reduction should not apply on the evaluation loading on account of functional guarantees and other loadings (if any, which are not dependent on quoted price). The summation of the revised / reduced quoted price and the evaluation loading on account of functional guarantees and other loadings (if any) shall be equal to the lowest evaluated bid (L1) price.

5.0 Verification of Local Content:

- 5.1 The local supplier shall be required to provide, in the relevant Attachment of Price Bid, self-certification / declaration that the Item offered meets the minimum local content and shall give details of the location(s) at which the local value addition is made as per relevant Attachment of Price Bid.
- 5.2 In cases the total bid price of the supplier / bidder is in excess of INR 10 crore, the local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.
- 5.3 False declarations will be dealt in line with the provisions of the Bidding documents pertaining to **Corrupt or Fraudulent Practices**.
- 5.4 A supplier who has been debarred / banned by any other procuring entity for violation of 'Public Procurement (Preference to Make In India), Order 2017' (PPP-MII Order) dated 15.06.2017 and its subsequent revisions / amendments issued by Department of Industrial Policy and Promotion (DIPP) shall not be eligible for preference under the aforesaid procedures for duration of the

debarment. The local supplier shall be required to furnish a confirmation in this regard in the relevant Attachment of Price Bid.

6.0 Local Sourcing

The Bidder / Contractor are requested to encourage and promote domestic manufacturing and production of goods and services by sourcing goods and services applicable under the contract / package from domestic suppliers / service providers. In this regard, Bidder shall also follow guidelines / advisory issued by Government of India from time to time, to the extent applicable to them, regarding promotion of local sourcing of goods including Bought out Items and services.

BID FORM STAGE-II (PRICE) BID

Proposal Ref. No.....

Date :

IFB No:**Bid Doc. No. : THDC/RKSH/CC-9915-371**

Name of Package : **TURBINE GENERATOR AND ASSOCIATED PACKAGES FOR
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW)
BIDDING DOCUMENT NO. THDC/RKSH/CC-9915-371**

To
Corporate Contracts,
THDC India Ltd.,
PragatiBhawan, By-Pass Road,
Pragatipuram, Rishikesh - 249 201

Gentlemen and/or Ladies,

1.0 Having examined the **Bidding Documents No. THDC/RKSH/CC-9915-371**, including subsequent amendments and clarifications if any, the receipt of which is hereby acknowledged, we the undersigned, offer to design, manufacture, test, deliver, construct, install and commission (including carrying out Guarantee Test) the facilities under the above-named Contract in full conformity with the said Bidding Documents for the sum **(excluding taxes & duties indicated by us in Schedule-7 & 7A)** as mentioned in Bid invitation at www.eprocure.gov.in site or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.0 **ATTACHMENTS TO THE BID FORM STAGE-II (PRICE) BID:**

2.1 In line with the requirements of the Bidding Documents, we enclose herewith the following Attachments & Price Schedules, duly filled-in as per your proforma:

(a) Attachment 1(P) :	Extension of Bid Security in the form of (Please fill in the alternative chosen) for a sum of (Name of currency and amount in words & figures) valid for a period of 225 days from the date set for opening of Stage-II (Price) bids. As required, the Attachment-1(P) (i.e. Bid Security) has been furnished in physical form in a separate sealed envelope.
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- | | | |
|------|--------------------------|---|
| (b) | Attachment 2(P) : | A power of attorney duly notarized by a Notary Public indicating that the person(s) signing the bid have the authority to sign the bid and thus that the bid (price bid) is binding upon us during the full period of its validity in accordance with the ITB Clause No.13. As required, the Attachment-2(P) (i.e. Power attorney) has been furnished in physical form in a separate sealed envelope. |
| (c) | Attachment-3(P) | Certificate of Compliance to all provisions of Bid Documents. |
| (d) | Attachment-4(P) | Declaration regarding Import Content as per your format enclosed in the Bidding Documents. |
| (e) | Attachment-4A(P) | The declaration regarding Custom duty benefits for import of Construction Equipment considered in the Bid. |
| (e1) | Attachment-4(P1) | DELETED |
| (f) | Attachment-5(P) | DELETED |
| (h) | Attachment-6(P) | DELETED |
| (i) | Attachment-7(P) | Details of equipment and mandatory spares to be imported from Associate/Collaborator by the Manufacturer or the bidder indicating value of items. |
| (j) | Attachment-8(P) | Details of our Local Representation including remuneration amount. |
| (k) | Attachment-9(P) | Price Adjustment Data. |
| (l) | Attachment-10 (P) | <i>Declaration regarding local content as per the Employer's format, for granting of purchase preference.</i> |

- (m) **Attachment 9 (Rev.01):** *List of Construction and Erection Tools & plants and safety equipment & safety personal protective equipments which we propose to bring to site in case the Contract is awarded to us.*
- (n) Attachment-11 (P) Check list of documents to be submitted in Stage-II (Price) Bid.

2.2 PRICE SCHEDULES

In line with the requirements of the Bidding Documents, we enclose herewith the following Price Schedules, duly filled-in as per your proforma :

- | | |
|----------------------|---|
| Schedule No. 1 | Plant and Equipment (including Type Test charges) and Mandatory Spares to be supplied from abroad |
| Schedule No. 2 | Plant and Equipment (including Type Test charges) and Mandatory Spares to be supplied from within the Employer's country. |
| Schedule No. 3 | Local Transportation including port handling, port clearance, port charges, custom reconciliation inland transit insurance and other local costs incidental to delivery of plant and equipment and mandatory spares |
| Schedule No. 4 | Installation Services including Erection Works, Civil, Structural and Allied Works, Insurance covers other than inland transit insurance and other services as specified in the bidding documents |
| Schedule No. 5 | Grand Summary |
| Schedule No. 6 | Recommended Spare Parts |
| Schedule No. 7 | Goods and Services Tax (GST), applicable on Schedules - 2, 3 & 4, not included in bid price. |
| Schedule No. 7A | Import duty and Goods and Services Tax (GST), applicable on Schedule-1, not included in bid price. |
| Schedule No. 8A & 8B | Breakup of Type Test Charges in Schedule 1 & 2 respectively. |
| Schedule No. 9 | Schedule of Take Out Price |
| Schedule No. 10 | Schedule of Unit Rates |
| Schedule No. 11 | Schedule of Alternatives |
| Schedule No. 12 | Schedule of Optional Items/Services |

- 3.1 We are aware that the Price Schedules do not generally give a full description of the work to be performed under each item and we shall be deemed to have read the Technical Specifications, Drawings and other sections of the Bidding Documents to ascertain the full scope of work included in each item while filling in the rates and prices. We agree that the entered rates and prices shall be deemed to include the full scope as aforesaid, including overheads and profit.
- 3.2 We declare that as specified in the General Conditions of Contract (Clause 11.2) prices quoted by us in the Price Schedule shall be subject to adjustment in accordance with Appendix-2 (Price Adjustment) to the Contract Agreement.
- 3.3 We understand that in the price schedules, where there are discrepancy between the unit price and the total price, which is obtained by multiplying the unit price and quantity, or between subtotals and the total price, (even in case of carry forward of prices) the unit or subtotal price shall prevail and the total price shall be corrected accordingly. We further understand that where there is a discrepancy between amounts stated in figures and amounts stated in words, the amount stated in words shall prevail. Similarly, in case of any discrepancies between the total bid price and the summation of Schedule prices (price indicated in a Schedule indicating the total of that Schedule), the total bid price shall be corrected to reflect the actual summation of the Schedule prices.
- 3.4 We declare that prices left blank in the Schedules will be deemed to have been included in the prices of other items. The TOTAL for each Schedule and the TOTAL of Grand Summary shall be deemed to be the total price for executing the Facilities in complete accordance with the Contract, whether or not each individual item has been priced.
- 4.0 We confirm that except as otherwise specifically provided, our Bid Prices include all taxes, duties, levies and charges including GST, assessed on us, our Sub-Contractor / Sub-Vendor, our assignee and our assignee's sub-contractor/sub-vendor (if applicable, in case of foreign bidders) or their employees by all Municipal, State or National Government authorities in connection with the Facilities, in and outside of India.
- 4.1 We understand that notwithstanding 4.0 above, we shall bear and promptly pay/reimburse all customs duties and GST, if imposed on the Plant and Equipment including Mandatory Spares to be supplied from abroad and specified in Schedule No.1 (and on recommended spare parts to be supplied from abroad and specified in Schedule No.6, if awarded) to be incorporated into the Facilities, by the Indian Laws. Further, you will reimburse the above Custom duties and GST subject to furnishing of documentary evidence by us.

However, we understand that if we choose to ship the equipment in Shipper's Containers, then the custom duty, GST and any other tax/duty levied on the cost of such empty Containers shall not be borne by you and shall be borne and payable/reimbursable by us. Further, in case any additional duties under Customs like Anti-dumping duty, Counter-vailing duty on subsidised articles, Safeguard duty etc. and any other tax including GST, levies, cess etc. applicable in such additional duties, is imposed on Plant and Equipment including Mandatory Spares/ Recommended Spares, the same shall be borne and paid/reimbursed by us.

Further, payment of custom duty, custom clearances, any wharfage /demurrage /penalty, if levied on account of nonfulfillment of contractual obligation /documentation shall be to Contractor's account".

- 4.2 "We further understand that notwithstanding 4.0 above, you shall also bear and pay/reimburse to us/our Assignee (if applicable, in case of foreign bidder) GST applicable on: (a) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country specified in Price Schedule No. 2 (and also on locally supplied Recommended Spare Parts quoted in Price Schedule No. 6, when awarded) to be incorporated in the Facilities, by the law of country where the site is located, (b) local transportation & insurance, other local costs incidental to delivery of plant & equipment including mandatory spares specified in Price Schedule No. 3 (and also of locally supplied Recommended Spare Parts quoted in Price Schedule No. 6, when awarded) and (c) Installation Services including Erection, Civil & Allied Works and other services specified in Price Schedule No. 4. However, all other taxes, duties & levies as may be applicable on goods and services specified in Price Schedules Nos. 2, 3 & 4 and on the materials used for civil construction works and erection & commissioning shall be to our account and no separate claim in this regard will be entertained by you.

Taxes and Duties which are payable by the Employer under the Contract shall be reimbursed by the Employer to the Contractor after receipt of equipment/spares at site and on production of satisfactory documentary evidence by the Contractor. **However, GST as applicable on Down payment/Advance sanctioned to Contractor shall be paid to the Contractor alongwith the Down payment/Advance sanctioned. We undertake that the amount of this GST shall be progressively adjusted against Tax Invoices at the time of supply/dispatch of equipments.**

- 4.3 We confirm that we (or our Assignee, if applicable in case of foreign bidders as per para on Construction of Contract in Techno-Commercial Bid Form) shall get registered as per relevant GST laws.

4.4 **Income Tax**

We hereby declare that if any Indian Income Tax, surcharge on Income Tax and any other tax is attracted under the law, we agree to pay the same to the concerned authorities and you shall have no additional tax liabilities whatsoever irrespective of the mode of contracting.

5.0 **COMPLIANCE TO THE PROVISIONS OF THE BIDDING DOCUMENTS**

- 5.1 We have read all the provisions of the Bidding Documents and confirm that notwithstanding anything stated anywhere in our bid to the contrary, the provisions of the Bidding Documents are acceptable to us and we further confirm that we have not taken any deviation to the provisions of the Bidding Documents anywhere in our bid.

We have furnished our compliance to the provisions of the Bidding Documents and its subsequent Amendment(s)/Clarification(s)/Addenda/Errata by submitting Attachment -3P (Certificate of Compliance to all provisions of Bid Document).

Submission of above Attachment-3P shall be considered as our confirmation that any deviation to the Provisions of Bidding Documents found anywhere in our Bid Proposal, implicit or explicit, shall stand unconditionally withdrawn, without any cost implication whatsoever to the Employer, failing which our bid security shall be forfeited.

5.2 We further declare that additional conditions, variations, deviations, if any, found in the Price Bid, save those pertaining to any rebates offered, shall not be given effect to.

6.0 We declare that we have quoted the plant and equipment including spares to be supplied from abroad on CIF (Indian port-of-entry) basis.

@We confirm that we are seeking qualification on the basis of association/collaboration with the manufacturer(s) of particular equipment(s). We further confirm that the plant and equipment including mandatory spares, which shall be imported from the associate's/collaborator's country by the manufacturer or by us, have been listed in Attachment-7(P) to Bid Form and the price of these equipment and mandatory spares have been included in the total CIF (Indian port-of-entry) price quoted by us in Schedule-1.

6.1 **For Payments related to Erection / Civil / Site Fabricated Structural works**

We confirm that a single designated ESCROW account shall be opened by us in any Scheduled Bank of India under intimation to Employer. All payments related to Erection / Civil / Site Fabricated Structural works by the Employer due under the contract to us shall be released into above-mentioned ESCROW account set up as per the Tri-Partite Escrow Agreement between us, Employer, and Escrow Bank. The payment shall be disbursed in accordance with the mechanism set out in the Contract and Escrow Agreement. The purpose of the Escrow Account would be to ensure that payments received under the contract are solely used for implementation of the Contract. Under Tri-partite Escrow Agreement, the Escrow Bank will agree to ensure that amounts received in the ESCROW Account are utilized for making payments only to suppliers of goods and services related to Erection / Civil / Site Fabricated Structural works, statutory authorities, establishment expenses etc. as may be required in the performance of the contract.

We further confirm that all expenses/charges for opening /operation (including Annual Fee) of the Escrow Account shall be paid by us.

The draft agreement as annexed as Annexure-3 to Appendix-1 to Form of Contract Agreement, shall be followed for executing Escrow Account Agreement.

The Detailed Operative Procedure and Terms and Conditions of Escrow Account (Schedule III of draft agreement) shall be finalized between us, the Employer, and the Escrow Bank within 15 days of the placement of award.

7.0 We undertake, if our bid is accepted, to commence work on the Facilities immediately upon your Notification of Award to us and to achieve Completion of Facilities and conduct Guarantee Tests within the time specified in the Bidding Documents.

- 7.1 We confirm that, in terms of the requirement of Sub-Clause no. 44.01.00 (iv) under 'Work & Safety Regulations' (Clause no. 44.00.00 of Erection Conditions of Contract of Technical Specifications, Section-VI, Part-D of Bidding Documents), the 'Safety Plan' shall be submitted within 60 days from the date of award of contract for approval of Engineer-in-charge (EIC) / Project Manager of Employer.
- 8.0 We hereby confirm that the rates/prices quoted by us in Schedule-9 (Schedule of Take Out Prices) and Schedule-10 (Schedule of Unit Rates) are consistent with the lumpsum bid price and that we shall furnish all necessary justification to establish the reasonableness of these rates/prices, if required by you. However, we clearly understand that the acceptance of our proposal for the subject package shall not mean automatic acceptance of these rates/prices and that these rates/prices shall be adopted only if their reasonableness has been established by us and accepted by you.
- 9.0 If our bid is accepted, we undertake to provide Down Payment Security, Contract Performance Securities, Performance Securities for Phase manufacturing programme and securities for Deed(s) of Joint Undertaking (as applicable) in the form and amounts and within the time specified in the Bidding Documents.
- 10.0 We agree to abide by this Stage-II (Price) Bid for a **period of 180 days** from the date of opening of bids as stipulated in the Bidding Documents and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period. Techno - Commercial Bid (Stage-I) including this Price Bid (Stage-II) shall remain valid and open for acceptance for One Hundred Eighty (180) days from date of Bid Opening of this Price Bid (Stage-II). Further, the prices of recommended spares contained in our Bid shall remain valid for a period of 6 months after placement of Notification of Award for main equipment and mandatory spares.
- 11.0 Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

Name and address of agent	Amount and Currency	Purpose of Commission or gratuity

(If none, state "none")

- 12.0 Until a formal Contract is prepared and executed between us, this bid, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.
- 13.0 We understand that you are not bound to accept the lowest or any other bid you may receive.
- 14.0 We confirm that cost of Special Tools & Tackles furnished by us in Attachment-4A of our Stage-I (Techno-Commercial) Bid is included in lumpsum price quoted in this Price Bid.
- 15.0 DELETED
- 16.0 We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal, is in all respects for and in good faith, without collusion or fraud.

Dated this.....day of.....20.....

Thanking you, we remain,

Yours faithfully,

Date :	(Signature).....
Place :	(Printed Name).....
	(Designation).....
	(Company Seal).....

AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

SL. NO.	SPECIFICATION REFERENCE				Existing	Read as
	SEC/ PART	SUB SEC.	PAGE NO.	CLAU SE NO.		
1	VI/B	A-01	3 of 3	1.06.00	New clause added	a) Provision for life consumption/Equivalent Operating Hours (EOH) of critical components due to Creep & Fatigue shall be made available online (display in CCR) for operating personnel. Also program/measures shall be made available online (display in CCR) to guide the operating personnel for maintenance planning. b) Resulting Damage Factor due to Creep-Fatigue interaction shall be made available online (display in CCR) for Operating personnel.
2	VI/B	A-3	24 of 92	1.20.00/ (q)	New clause added	All the piping, fittings, valves, oil tanks, strainers including body and element associated with oil system of HP & LP bypass system shall be of stainless steel.

AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

3	General VI/A	A-2	1/3	1.03.00	First Fill of Consumable, Oils & Lubricants All the first fill of consumables and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases (excluding H₂, CO₂ and N₂ for Generator) and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning/initial operation and to establish completion of facilities shall be furnished by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder scope shall also include supply of H₂, CO₂ and N₂ as applicable for the Generator till successful commissioning of the Generator. Bidder shall also supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases, chemicals etc (as detailed above). used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers.	First Fill of Consumable, Oils & Lubricants i. All the first fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases (excluding H₂, CO₂ and N₂ for Generator) and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder scope shall also include shall also supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases, chemicals etc.(as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate Containers. ii. Bidder scope shall supply H₂, CO₂ and N₂ as applicable for the Generator till successful commissioning of the Generator.
4	VI/B	A-3	27 of 92	1.22.01 (o)	All HP heaters out of service under rated steam conditions at condenser pressure of 77 mm Hg (abs) and 89 mm Hg (abs) with zero percent make up and 3% make-up and rated output.	All HP heaters out of service under rated steam conditions at condenser pressure of 77 mm Hg (abs) and 89 mm Hg (abs) with zero percent make up and 3% make-up and rated not less than 660 MW or output corresponding to design BMCR heat duty, whichever is lower.
5	VI/B	A-3	50 of 92	5.02.00/ (g)	Hardened 400 series stainless steel impingement plates for flashed drain inlet from HP heaters, BFP recirculation, boiler startup drains etc.	Hardened 400 series or 304 series stainless steel impingement plates for flashed drain inlet from HP heaters, BFP recirculation, boiler startup drains etc.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW)

TURBINE GENERATOR AND ASSOCIATED PACKAGES

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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

6	VI/B	A-3	11 of 92	1.06.01	On-line Blade Vibration Monitoring System for Low Pressure (LP) Turbines (in case Free Standing Blades are offered) (a) System Requirement (1)..... (2)..... (21).....	On-line Blade Vibration Monitoring System for Low Pressure (LP) Turbines (in case Free Standing Blades are offered) (a) System Requirement (1)..... (2)..... (21)..... NOTE: In case the Blade design comprises integral shroud and snubber which becomes integral at higher speed due to continuous centrifugal force shall not be treated as free standing blade.
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

7	VI/B	A-3	16 of 92	1.13.00/ (d)	INSULATION (STEAM TURBINE AND BFP) (d) The thermal insulation for the turbine casing shall preferably be insulated by preformed ceramic mattress blankets conforming to IS15402 or equivalent. These mattresses are fixed over the casing and held in position by metallic washers fastened to the MS rod welded to the casing. To meet the thickness requirements, multiple layers of mattresses may be applied. Alternatively, bidder may apply turbine insulation as per their standard practice i.e. sprayed insulation produced by projecting specially prepared mineral wool along with a fine liquid spray. However, the casing parting plane shall necessarily be provided with blanket type insulation. The bidder may apply complete spray type or complete blanket type or combination of both of above as per their standard practice. These blankets shall consist of high temperature felted mineral insulation fully enclosed in wire inserted asbestos free cloth for temperature exposure to 445oC to 595oC. A single layer of blanket shall not be more than 75 mm thick. Voids around the blankets should be avoided. However, unavoidable voids shall be filled with loose mineral wool.	INSULATION (STEAM TURBINE AND BFP) (d) The thermal insulation for the turbine casing shall preferably be insulated by preformed ceramic mattress blankets conforming to IS15402 or equivalent. These mattresses are fixed over the casing and held in position by metallic washers fastened to the MS rod welded to the casing. To meet the thickness requirements, multiple layers of mattresses may be applied. Alternatively, bidder may apply turbine insulation as per their standard practice i.e. sprayed insulation produced by projecting specially prepared mineral wool along with a fine liquid spray. However, the casing parting plane shall necessarily be provided with blanket type insulation. The bidder may apply complete spray type or complete blanket type or combination of both of above as per their standard practice. These blankets shall consist of high temperature felted mineral insulation fully enclosed in wire inserted asbestos free cloth for temperature exposure to 445°C to 595°C. A single layer of blanket shall not be more than 75 mm thick. Voids around the blankets should be avoided. However, unavoidable voids shall be filled with loose mineral wool.
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

8	VI/B	A-3	33 of 92	2.02.00 (a)	The Condenser shall be designed for heat load corresponding to valve wide open (VVO) condition, 3% makeup and guaranteed condenser pressure and conditions given at Annexure-II of this sub-section. The value of condenser pressure to be measured at 300 mm above the top row of condenser tubes shall be demonstrated under VVO output condition, 3% make-up. The condenser vacuum shall be measured with a vacuum grid utilizing ASME basket tips. The grid is fitted at 300 mm above top row of tubes of condenser. Condensate temperature at all loads shall be near to the saturation temperature corresponding to condenser pressure	The Condenser shall be designed for heat load corresponding to valve wide open (VVO) condition, 0% makeup and guaranteed condenser pressure and conditions given at Annexure-II of this sub-section. The value of condenser pressure to be measured at 300 mm above the top row of condenser tubes shall be demonstrated under VVO output condition, 0% make-up . The condenser vacuum shall be measured with a vacuum grid utilizing ASME basket tips. The grid is fitted at 300 mm above top row of tubes of condenser. Condensate temperature at all loads shall be near to the saturation temperature corresponding to condenser pressure
9	VI/A	A-3	9 of 10	13.00.0 0	TOOLS AND TACKLES 13.01.00 The set of maintenance and repair tools including all special tools and tackles used during the installation, commissioning, testing, calibration, modification and maintenance shall be handed over to the employer. 13.02.00 In addition, one set of all special tools and tackles required for the installation, commissioning, testing, calibration, modification and maintenance of equipment(s)/ system shall also be supplied. These tools and tackles shall not be used for erection/commissioning purposes and shall be in new condition, when handed over to the Employer. These tools and tackles shall be separately packed and brought to site. A list of all such special tools and tackles shall be submitted along with the offer.	TOOLS AND TACKLES 13.01.00 The set of maintenance and repair tools including all special tools and tackles used during the installation, commissioning, testing, calibration, modification and maintenance shall be handed over to the employer. 13.01.00 One set of all special tools and tackles required for the installation, commissioning, testing, calibration, modification and maintenance of equipment(s)/ system shall be supplied. These tools and tackles shall not be used for erection/commissioning purposes and shall be in new condition, when handed over to the Employer. These tools and tackles shall be separately packed and brought to site. A list of all such special tools and tackles shall be submitted along with the offer.
10	VI/G	TDS/DA2(I)	4 of 30	1.01.01	(x) 65% unit rated output under modified sliding pressure operation at condenser pressure of 77 mm Hg (abs) with 0% and 3% make up.	(x) 60% unit rated output under modified sliding pressure operation at condenser pressure of 77 mm Hg (abs) with 0% and 3% make up

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW)

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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

11	Amendment no. 14	GTR	53	24.00.00	Software based project monitoring tool	Deleted
12	VI/Part B	SUB-SECTION-III-18 WIRELESS INSTRUMENTS & SYSTEM INCLUDING FIELD BUS INSTRUMENTS	7 of 10	11.00.00	FIELD INSTRUMENTS BASED ON FIELDBUS The following instruments shall be connected to DDCMIS through fieldbus i.e. FOUNDATION Fieldbus/PROFIBUS PA protocol complying to IEC 61158 directly from transmitter.	FIELD INSTRUMENTS BASED ON FIELDBUS The following instruments shall be connected to DDCMIS through fieldbus i.e. FOUNDATION Fieldbus/PROFIBUS PA protocol complying to IEC 61158 directly from transmitter. For all fieldbus based instruments, GSD and DTM files are to be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics.

AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

13	VI/ Part B	IIC- 19 ELEC TRIC ACTU ATOR S	3 of 4	3.01.00	INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through hardwired signal only. (a) Open/Close commandshall be provided hardwired. (d) For typical wiring diagram Refer Tender Drawing No. 0000-999-POI-A-063 (Except plug & socket connector, if not applicable)	INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through hardwired signal only. (a) Open/Close commandshall be provided hardwired. (d) For typical wiring diagram Refer Tender Drawing No. 0000-999-POI-A-063 (Except plug & socket connector, if not applicable) (e) For INCHING type actuators, hardwired analog position signal (4-20mA) derived from absolute encoder to be provided for actuator position.
14	VI/ Part B	IIC- 19 ELEC TRIC ACTU ATOR S	3 of 4	4.01.00	INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through fieldbus network. (a) Open/ close commandsthe fieldbus network. (b) All actuatorsany manual intervention. (c) Open/close command termination logic shall be suitably built inside actuator.	INTERFACES: For ON-OFF and INCHING type actuators interface with the control system shall be through fieldbus network. (a) Open/ close commandsthe fieldbus network. (b) All actuatorsany manual intervention. Also, for 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. (c) Open/close command termination logic shall be suitably built inside actuator. (d) For all actuators GSD and DTM files are to be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics.

AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

15	VI/ Part A	SUB- SECTI ON - IIC- 02 DDCM IS ANNE XURE IIC- 02K	1 of 3	1.02.00	The fieldbus segment design shall be finalized and validated based on functional requirements as per: • Process requirements (P&IDs/ operational requirements). However, all such segment device allocation, topology shall be decided during detailed engineering.	New point Added The fieldbus segment design shall be finalized and validated based on functional requirements as per: • Process requirements (P&IDs/ operational requirements). • Profibus DP network termination shall be designed such that absence of power supply to terminating device in network does not affect other devices in the network. The Contractor shall furnish details and this shall be finalized during detailed engineering stage. • For all fieldbus devices GSD and DTM files are to be provided and configured/ tested in the DCS for proper interfacing and diagnostics. However, all such segment device allocation, topology shall be decided during detailed engineering.
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KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371	AMENDMENT NO. THDC/RKSH/CC-9915-371-AMDT-20	Page 8/ 28
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

16	VI/ Part A	SUB- SECTI ON- IIC CONT ROL & INSTR UMEN TATI ON SYSTE M	28 of 33	16.00.00	ELECTRICAL ACTUATORS Electric actuators with integral starters along with associated accessories etc shall be supplied on as required basis for Valves / Dampers to meet the functional and the other specification requirements. Following types of Electric Actuators are envisaged for the project: a) Non-intrusive Hardwired Electric Actuators b) Non-intrusive Fieldbus based Electric Actuators. For detail specification refer Sub-section-IIIC-19, Part -B, Section-VI of Technical Specification Applications are defined at Clause no.1.11.00 above. For erection and commissioning of above specified actuators, qualified and experienced engineers of actuator manufacturer shall be deputed at site. thereafter actuator service Engineer shall be deputed on call basis upto completion of facilities of the plant for troubleshooting and maintenance of actuators and proper interfacing with DDCMIS. Qualified and experienced engineers indicated above shall have expertise in all aspects of nonintrusive actuators along with fieldbus protocol and interfacing with DDCMIS.	ELECTRICAL ACTUATORS Electric actuators with integral starters along with associated accessories etc shall be supplied on as required basis for Valves / Dampers to meet the functional and the other specification requirements. Following types of Electric Actuators are envisaged for the project: a) Non-intrusive Hardwired Electric Actuators b) Non-intrusive Fieldbus based Electric Actuators. If electric actuator requires any additional power supply/ signal for its operation complying to specification requirements, then required power supply, cabling and termination etc. shall be provided by the contractor. For detail specification refer Sub-section-IIIC-19, Part -B, Section-VI of Technical Specification Applications are defined at Clause no.1.11.00 above. For erection and commissioning of above specified actuators, qualified and experienced engineers of actuator manufacturer shall be deputed at site. thereafter actuator service Engineer shall be deputed on call basis upto completion of facilities of the plant for troubleshooting and maintenance of actuators and proper interfacing with DDCMIS. Qualified and experienced engineers indicated above shall have expertise in all aspects of nonintrusive actuators along with fieldbus protocol and interfacing with DDCMIS.
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

17	VI/ A	SUB- SECTI ON- IIC CONT ROL & INSTR UMEN TATI ON SYSTE M	3 of 33	1.11.0 1	"For close loop control of following applications of main plant SG/TG/BOP (Auxiliaries of SG and TG), conventional i.e. 4-20 mA / (HART) based actuators along with 4-20 mA (HART) based electronic transmitters (which are directly used in control of final control element), shall be provided. For balance measurements for even these areas/ applications fieldbus based PT/DPT/TT shall be provided. For balance applications of main plant and for all applications of other areas including offsite areas fieldbus based control system, fieldbus based actuators and fieldbus based PT/DPT/TT shall be provided."	"For close loop control of following applications of main plant TG/ TG BOP (Auxiliaries of TG), conventional i.e. 4-20 mA / (HART) based actuators along with 4-20 mA (HART) based electronic transmitters (which are directly used in control of final control element), shall be provided. For balance measurements for even these areas/ applications fieldbus based PT/DPT/TT shall be provided. For balance applications of main plant and for all applications of other areas including offsite areas fieldbus based control system, fieldbus based actuators and fieldbus based PT/DPT/TT shall be provided."
18	VI/ Part A	SUB- SECTI ON- IIC CONT ROL & INSTR UMEN TATI ON SYSTE M	4 of 33	1.11.02 , G.	The actuators shall be fully compatible with the valves being provided in this package. Further, 20 Nos. configuration/ diagnostic tool (if applicable) for nonintrusive actuators and 20 nos. configuration/ diagnostic tool (if applicable) for all fieldbus compatible devices shall be provided for complete package.	Contractor shall provide Configuration/ Diagnostic tools for fieldbus (FF/ Profibus) network/ devices as below : a. Configuration/ diagnostic tool (if applicable) for non-intrusive actuators - 5 Nos. or 5% of total quantity of actuator whichever is more. b. Configuration/ diagnostic tool for all Foundation Fieldbus based instruments – 2 Nos of each make. c. Configuration/ diagnostic tool for Profibus network like Profitrace/ Profibus modem – 2 nos. per DDCMIS. Contractor shall provide all required software (lifetime licensed) and hardware (cables/ connectors, Tablet/ Laptop etc.) along with these tools.
19	VI/A	SUB- SECTIO N-IIC, CONTR OL & INSTRU MENTA TION SYSTEM	14 of 39	2.04.15	"DDCMIS vendor shall upgrade/ update all DDCMIS system along with Station LAN to the latest version..... contractor within the contract price."	"DDCMIS vendor shall upgrade/ update all DDCMIS system along with Station TG LAN to the latest version..... contractor within the contract price."

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20	VI/A	SUB-SECTION-IIC, CONTROL & INSTRUMENTATION SYSTEM	2 of 2		<table><tr><td></td><td>TG LAN</td><td></td><td></td></tr><tr><td></td><td>Unit</td><td>Quantity per Unit</td><td>Quantity Common</td></tr><tr><td>....</td><td></td><td></td><td></td></tr><tr><td>Redundant TG LAN</td><td>Sets</td><td></td><td>1</td></tr><tr><td>Redundant TG LAN Switch</td><td>Sets</td><td></td><td>1</td></tr><tr><td>...</td><td></td><td></td><td></td></tr></table>		TG LAN				Unit	Quantity per Unit	Quantity Common					Redundant TG LAN	Sets		1	Redundant TG LAN Switch	Sets		1	...				<table><tr><td></td><td>TG LAN</td><td></td><td></td></tr><tr><td></td><td>Unit</td><td>Quantity per Unit</td><td>Quantity Common</td></tr><tr><td>....</td><td></td><td></td><td></td></tr><tr><td>Network Management Server along with Software</td><td>Sets</td><td></td><td>1</td></tr><tr><td>Redundant TG LAN</td><td>Sets</td><td></td><td>1</td></tr><tr><td>Redundant TG LAN Switch</td><td>Sets</td><td></td><td>1</td></tr><tr><td>Hardware Firewall in failover mode with IPS</td><td>Nos.</td><td></td><td>2</td></tr><tr><td>VPN Router for Remote Service Centre Connectivity</td><td>Nos.</td><td></td><td>1</td></tr><tr><td>....</td><td></td><td></td><td></td></tr></table> Please Note: With this amendment, point no. 29 of Amendment No. 14 to bidding documents (technical specifications) that was issued earlier stands withdrawn.		TG LAN				Unit	Quantity per Unit	Quantity Common					Network Management Server along with Software	Sets		1	Redundant TG LAN	Sets		1	Redundant TG LAN Switch	Sets		1	Hardware Firewall in failover mode with IPS	Nos.		2	VPN Router for Remote Service Centre Connectivity	Nos.		1				
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21	VI/A	MANDATORY SPARES, C&I MANDATORY SPARES	33 of 59	1.00.00, (1.)	<table><tr><td>A.</td><td>(v) Server for Station LAN</td><td></td><td>1 No.</td></tr><tr><td>..</td><td>...</td><td></td><td></td></tr><tr><td>D.</td><td>(i) Switch/repeaters/ hubs/ firewalls for DDCMIS including Station LAN etc.</td><td></td><td>2 nos. of each type and model</td></tr></table>	A.	(v) Server for Station LAN		1 No.	..	...			D.	(i) Switch/repeaters/ hubs/ firewalls for DDCMIS including Station LAN etc.		2 nos. of each type and model	<table><tr><td>A.</td><td>(v) Server for Station LAN</td><td></td><td>1 No.</td></tr><tr><td>..</td><td>...</td><td></td><td></td></tr><tr><td>D.</td><td>(i) Switch/repeaters/ hubs/ firewalls for DDCMIS including TG LAN etc.</td><td></td><td>2 nos. of each type and model</td></tr></table>	A.	(v) Server for Station LAN		1 No.	..	...			D.	(i) Switch/repeaters/ hubs/ firewalls for DDCMIS including TG LAN etc.		2 nos. of each type and model																																				
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

22	VI/B	IIIC-13	8 of 9	4.01.00	This shall include piping, fittings, valves and accessories from tapping point upto SWAS conditioning panel located in SWAS room on as required basis. All sample piping shall be 3/4" NB seamless type of material ASTM A213 TP 316 H, conforming to ANSI B36.19. The schedule number shall be suitable for the particular application.	This shall include piping, fittings, valves and accessories from tapping point upto SWAS conditioning panel located in SWAS room on as required basis. All sample piping shall be 3/4" NB seamless type of material ASTM A213 TP 316 H (conforming to ANSI B36.19) or better (as per process pipe) . The schedule number shall be suitable for the particular application.
				4.02.00	All fittings shall be socket welding type and of material ASTMA182 F316H conforming to ANSI B 16.11.	All fittings shall be socket welding type and of material ASTMA182 F316H (conforming to ANSI B 16.11) or better (as per process pipe) .
				4.02.05	Material Specifications for Sample Pipe Lines The piping to be furnished and installed for water and steam analysis system shall be as indicated below: -----	Material Specifications for Sample Pipe Lines The piping material to be furnished and installed for water and steam analysis system shall have minimum specification as indicated below: -----

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23	VI/B	D-01	11 OF 142	5.02.01	Main Power House iii. Architectural Features This building shall be of Structural Steel Glazing for A Row & gable end shall be reflective 6mm thick clear toughened glass with Aluminium frame. Hermetically sealed double glazing shall be provided between air conditioned & non air conditioned areas. Internal glazed partition in side CCR/CER/Offsite Control Room and B-Row at operating floor level shall be of fire resistant glass having 2 (Two) hour fire rating and with suitable frame. Light weight aerated concrete panels with Single Skin Metal Panel cladding shall be provided in exterior of UPS Battery room area and Control Equipment Room area. All internal side of Aerated concrete panel and columns in air-conditioned areas in MPH shall be encased with Aluminium Composite panel cladding from inside.	Main Power House iii. Architectural Features This building shall be of Structural Steel Glazing for A Row & gable end shall be reflective 6mm thick clear toughened glass with Aluminium frame. Hermetically sealed double glazing shall be provided between air conditioned & non air conditioned areas. Internal glazed partition in side CCR/CER/Offsite Control Room and B-Row at operating floor level shall be of fire resistant glass having 2 (Two) hour fire rating and with suitable frame. Autoclaved aerated Concrete Block with Single Skin Metal Panel cladding shall be provided in exterior of UPS Battery room area and Control Equipment Room area. All internal side of Autoclaved aerated Concrete Block wall and columns in air-conditioned areas in MPH shall be encased with Aluminium Composite panel cladding from inside.
24	VI/B	D-01	20 OF 142	5.04.00	Complete sewerage systemsubject to minimum combined capacity of 40 Cum/day. Alternatively, bidder may provide a 'Centralized Sewage Treatment Plant' for complete plant facilities with minimum combined capacity of 40 cum/day and MBBR technology shall be used for centralized sewerage treatment plant.	Complete sewerage systemsubject to minimum combined capacity of 20 Cum/day. Alternatively, bidder may provide a 'Centralized Sewage Treatment Plant' for complete plant facilities with minimum combined capacity of 20 cum/day and MBBR technology shall be used for centralized sewerage treatment plant.
25	VI/B	D-01	39 – 50 of 142	7.00.00	FOUNDATION SYSTEM AND GEOTECHNICAL DATA	FOUNDATION SYSTEM AND GEOTECHNICAL DATA
26	VI/B	D-01	62 of 142	8.07.01. 2 e)	All butt welds with plates thicker than 50mm and all site butts weld of main framing beam shall require post weld heat treatment as per procedure given in AWS D-1.1. Post heating shall be done up to 600°C and rate of application shall be 200°C per hour. The post heat temperature shall be maintained for 60 minutes per 2.5 cm. thickness. For maintaining slow and uniform cooling, asbestos pads shall be used for covering the heated areas.	All butt welds with plates thicker than 50mm and all site butts weld of main framing beam shall require post weld heat treatment as per procedure given in AWS D-1.1. Post heating shall be done up to 600°C and rate of application shall be 200°C per hour. The post heat temperature shall be maintained for 60 minutes per 2.5 cm. thickness. For maintaining slow and uniform cooling, asbestos free pads shall be used for covering the heated areas.

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27	VI/B	D-01	77 of 142	9.07.05	For control room , control equipment room, walls shall be of factory made composite modular light weight aerated concrete panels,(minimum 2 hours of fire rating)which is used at the top and bottom.	For control room, control equipment room, walls shall be constructed of Aerated Concrete Block (except in toilet and pantry area, where brick shall be used).
28	VI/B	D-01	87 of 142	9.13.05	Pre-Painted Coil coated Steel false ceiling system, at all level, for all kind of works, consisting of 0.5 mm thick galvanised as per IS: 277, along with galvanised supporting steel members exposed faces of galvanised member to be prepainted with regular modified polyester coating / super polyester coating minimum 20 DFT, to form panels of specified size for tile type panels and roll formed stove enamelled 0.6 mm thick steel carrier, for fixing of lineal type panels by clip on arrangement, suspended from RCC slab / structural steel or catwalk way steel channel grid above with 4 mm (minimum) galvanised wires (rods), with special height adjustment clips, providing angle section of minimum 25 mm leg width along the perimeter of ceiling, including all labour, material, supporting grid system (members minimum 0.8 mm thick and galvanised as per IS: 277) anchor fasteners for making suspension arrangement from RCC, providing openings for AC ducts, return air grills, insulation light fixtures, etc., all complete.	Aluminium false ceiling shall be in 600 mm x 600 mm tile of 0.6 mm thk.(minimum) with perforation of 2.5 mm dia in combination with built in nonwoven tissue for providing good acoustic properties having coil coating of thickness 25micron (minimum)and installed with T-Grid (of profile 24 mm) in same or contrasting colours or with 6 mm recess joints. The whole system shall be level adjusting arrangement and shall be suspended as per manufacturer guidelines of Luxalon, Armstrong or equivalent. Alluminium false ceiling shall be of Luxalon, Armstrong or equivalent.
29	VI/B	D-01	91-97 of 142	9.16.00	TABLE - B	TABLE - B Revised Table-B is attached as Annexure-II
30	VI/B	D-01	104 of 142	11.02.00	Workmanship and dimensional shall be checked as stipulated below.	Workmanship and dimensions shall be checked as stipulated in Part-B, Sub-Section E-47
31	VI/B	D-01	123-134 of 142	Annexure-C	Annexure C – BORE LOG DATA	Annexure C – BORE LOG DATA Revised Annexure-C to Sub-Section D-01 of Part-B of Technical Specification is attached as Annexure-III.
32	Amdment No. 4 S.No . 158	-	80 of 91	S.No. 158	Water Contractor shall make all arrangements himself for the supply of construction water as well as potable water for labour and other personnel at the worksite/colony. However, potable water can be drawn from bore-well if found suitable <i>and permitted by Statutory Authority</i> . Any statutory clearance required shall be obtained by the contractor.	Water Contractor shall make all arrangements himself for the supply of construction water as well as potable water for labour and other personnel at the worksite/colony. However, construction /potable water can be drawn from bore-well if found suitable <i>and permitted by Statutory Authority</i> . Any statutory clearance required shall be obtained by the contractor
33	Amdment No. 7		1 of 1	S.No. 1	Drawing no. 9915-999-POC-F-001 (REV. 1) titled "GENERAL LAYOUT PLAN"	Drawing no. 9915-999-POC-F-001 (REV. 2) titled "GENERAL LAYOUT PLAN"

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34	Ame ndm ent No. 7		1 of 1	S.No. 2	 9915-371-POC-A-002 titled "Layout of Roads" and 9915-371-POC-A-003 titled "Layout of Drains" added for information purpose only	 9915-371-POC-A-002 titled "Layout of Roads" Rev-B and 9915-371-POC-A-003 Rev-C titled "Layout of Drains" added for information purpose only
35	VI/ E	Tend er drawi ng		Sl.No.- 3	Layout plan at 8.5M/17.0M/24.0M/24.0M/28.0M/32.0M/38.0M, Drg No- 9915-999-POM-F-002 (Rev-A)	Layout plan at 8.5M/17.0M/24.0M/24.0M/28.0M/32.0M/38.0M, Drg No- 9915-999-POM-F-002 (Rev-B)
36	VI/ A	A2	3 of 3	1.07.0 1	Contractor shall prepare 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc), which is extracted from intelligent 3D model, for employer's review as & when desired by employer. However, all piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), structural arrangement drawings and RCC layout drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings.	Contractor shall prepare 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc), which is extracted from intelligent 3D model, for employer's review as & when desired by employer. However, all piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.) and structural arrangement drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable Owner to review and approve these drawings
37	VI Part - A	SPAR ES	26 of 59	21. Low Pressure Piping	a) Valves up to size 250 NB b) Valves above 250 NB	Note: 1. If there is one no valve only of particular type, class and size then only one no is required. 2. Wherever valves are specified as mandatory spare, complete valve along with actuator and all other accessories which are the part of original supply shall also be supplied

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38	VI Part -A	SPAR ES	28 of 59	22. Power Cycle Piping	1. Spare gaskets / pressure seal gaskets of all the gate valves of sizes 15 NB to 500 NB 25. Complete Valve assembly for sizes above 250 NB	Note: 1. Mandatory spare requirements of Valves and specialties for power cycle piping systems (Sub Section: II-A04 of Part-A of Technical Specifications) specified above does not include items/valves/specialties which are already specified/ covered elsewhere in this Technical specification for mandatory spare requirement. 2. Wherever complete valve assembly as mandatory spare has been specified above for power cycle piping, it shall include complete gear operator/ box assembly which forms part of original valve assembly/supply. 3. Mandatory spares for valve actuators (for Pneumatically, Hydraulically & Electrically operated valves) shall be supplied as per actuator quantity/details specified elsewhere in this technical specification for mandatory spare requirement. 4. Mandatory spare requirement for complete valve assembly above 50NB in power cycle piping systems shall include Gate valve, Globe valve, check valve, safety valve, Angle valve, butterfly valve etc. 5. In case the quantity of mandatory spares so calculated happens to be a fraction, the same shall be rounded off to next higher whole number. For example 10% of 11 is equal to 1.1, then it should be rounded as 2 instead of 1. 6. In case any of the above specified mandatory spares / Items are not covered in the actual design / supply, then that spares / items may be treated as "not applicable".
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39	VI Part -A	TERMINAL POINTS & EXCLUSIONS	2 of 6	5.01.01	For each unit, Bidder to tap off Secondary circuit cooling waterthe hot water into the CW system discharge pipe at the downstream of condenser.	For each unit, Bidder to tap off Secondary circuit cooling water from the Circulating Water System pipe/duct at the upstream of condenser and terminate the hot water into the CW system discharge pipe/duct at the downstream of condenser.
40	VI Part -A	TERMINAL POINTS & EXCLUSIONS	3 of 6	5.02.00	For all other plant water system terminal points,titled "Pipe & Trestle Layout ".	For all other plant water system terminal points, Bidder to refer the Doc.No.CW-CS-9915-999-POM-A-037 titled "Plant Water Scheme & TP details" and Doc.No. 9915-999-POM-F-006 titled "Pipe & Trestle Layout ". Boiler Fill Tap-off to be given to owner for use in SG area shall be terminated for each Unit separately.
41	VI Part -A	TERMINAL POINTS & EXCLUSIONS	3 of 6	6.00.00	For Compressed Air System terminal points, Bidder.....titled "Pipe & Trestle Layout ".	For Compressed Air System terminal points, Bidder to refer the Doc. No.CW-CS-9915-999-POM-A-037 titled "Plant Water Scheme & TP details" and Doc.No. 9915-999-POM-F-006 titled "Pipe & Trestle Layout ". Service & Instrument Air Tap-off to be given to Owner for use in SG Area shall be terminated for each Unit separately.

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42	VI Part -B	Annexure-A, Amendment 04_Part B_Low Pressure Piping. Sub Section A6	13 of 21	2.13.01 (a) (2)	Stainless steel valves Body & Bonnet SS 304 Disc -do- Trim. SS 316	Stainless steel valves Body & Bonnet SS 304 / SS 316 Disc -do- Trim. SS 304 / SS 316
43	VI/P art-E			Tender Drawing 9915- 999- POM-A- 004	9915-999-POM-A-004	Refer revised Tender drawing in Annexure.
44	VI Part -A	Sub. Sec. A-5	2 of 2	2.04.00 (h)	Complete Effluent transfer system up to Ash slurry sump pumps, piping, valves, fittings etc.	Complete Effluent transfer system up to Ash slurry sump pumps, piping, valves, fittings etc. Piping shall be terminated at terminal point, however the pumps head shall be sufficient for effluent disposal upto the final discharge point.
45	VI Part -A	Sub. Sec. A-5	2 of 2	2.04.00 (i)	Waste water generated during resin transfer operation along with piping, valves, fittings, Resin transfer waste water disposal pumps (2x100%) etc.	Waste water generated during resin transfer operation along with piping, valves, fittings, Resin transfer waste water disposal pumps (2x100%) etc. Piping shall be terminated at terminal point, however the pumps head shall be sufficient for effluent disposal upto the final discharge point.

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47	VI/A	B1	11 of 15	Annexur e-A	Note: 1. In Category I, Feeders of equipment (Motors, Transformers, etc.) in the scope of STG Island Package have not been considered shall be considered as per the technical specifications. 2. Above Employer's BOQ is tentative, which may vary during detailed Engineering. Final BOQ shall be provided during detailed Engineering. 3. Spares shall be considered as per Technical Specification for Switchgears under Category I. Spares have been included in Category II Switchgears (Employer's switchgear requirement).	Note: 1. In Category I, Feeders of equipment (Motors, Transformers, etc.) in the scope of TURBINE GENERATOR AND ASSOCIATED PACKAGES have not been considered shall be considered as per the technical specifications. 2. Above Employer's BOQ is tentative, which may vary during detailed Engineering. Final BOQ shall be provided during detailed Engineering. 3. Spares shall be considered as per Technical Specification for Switchgears under Category I. Spares have been included in Category II Switchgears (Employer's switchgear requirement). 4. For both category I & II, Employer's feeder requirement: DC/DE Breaker rating shall be same as or higher than switchboard rating. DD breaker rating shall be 2/3rd of Switchboard rating or higher. DBF/DBF1 breaker rating shall be minimum 1250A. CC/CCT Vacuum contactor rating shall be minimum 400A. DA/DAF/DB breaker rating shall be minimum 800A.
48	VI/B	B-7	2 of 11	6.01.01	Pressurisation System The pressurization of the busduct shall be done by clean dry air from pressurization system using air supply from plant compressed air system or dedicated compressor/blower. The system shall be suitable to ensure air leakage of not more than 5% of total enclosure volume per hour. System shall be complete with control and instrumentation, safety features, dryers, filters, blowers etc., after installation at site.	Pressurisation System The pressurization of the busduct shall be done by clean dry air from pressurization system using air supply from plant compressed air system or dedicated compressor/blower. System shall be complete with control and instrumentation, safety features, dryers, filters, blowers etc., after installation at site.
49	VI/B	Sub section A2	4 of 12	1.02.00 (h) point no.4	A common oil retention pit per unit shall be provided to hold oil quantity of the largest transformer (by volume) & 10 minutes of water quantity of HVW spray system for the largest transformer.	A common oil retention pit per unit or for both the unit shall be provided to hold oil quantity of the largest transformer (by volume) & 10 minutes of water quantity of HVW spray system for the largest transformer.
50	VI PART -E	SLD			9915-999-POE-J-002 Rev No B Single line Diagram-STG Package	9915-999-POE-J-002 Rev No C Single line Diagram-TURBINE GENERATOR AND ASSOCIATED PACKAGES
51	VI/B	B-15	20 of 36	1.11.07	Note vi) **During Infra red thermography test of GT, the temperature of any part of tank shall be limited to 85 deg C.	Note vi) **During Infra red thermography test of GT, the temperature of any part of tank shall be limited to 110 deg C.

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52	Part B, Section – VI	Sub-section E-47, Civil Works	6 of 24	6.6.0	Structural steel and Reinforcement steel supply if in the scope of the contractor shall be procured from Main Steel Producers. Currently, Main Steel producers considered as acceptable are SAIL, JSW Steel Ltd, Jindal Steel & Power, Tata steel Ltd. (for Reinforcement steel/TMT bars), RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Essar Steel India Ltd. (for Flat products/ Steel Plates), Electrosteel steel Ltd. (for Reinforcement steel/TMT bars) and Monnet Ispat and Energy Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequently, if any new Main Steel Producer/s are proposed during execution of the contract, they may be considered for acceptance after an assessment.	Structural steel (plates and rolled sections i.e. channels, beams & angles) and Reinforcement steel supply if in the scope of the contractor shall be procured from Primary Steel Producers (Refer NOTE below). Currently, Primary Steel Producers acceptable are SAIL, JSW Steel Ltd, Jindal Steel & Power, Tata steel Ltd. (for Reinforcement steel/TMT bars), RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Essar Steel India Ltd. (for Flat products/ Steel Plates), Electrosteel steel Ltd. (for Reinforcement steel/TMT bars) and Monnet Ispat and Energy Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequently, if any new Primary Steel Producer/s are proposed during execution of contract, the same may be considered for acceptance subject to meeting the following qualifying requirements: i) The proposed supplier should be a Primary Steel Producer, having a minimum production capacity of one million tons per annum (MTPA). ii) The proposed supplier should be a regular manufacturer of Steel Plates and / or Rolled Sections and / or Reinforcement Steel for the last two years as on date of submission of proposal. iii) The proposed supplier should also be a registered licensee with Bureau of Indian Standards for BIS:1786/2062 at the time of submission of proposal. NOTE: The "Primary Steel Producer" shall mean Steel Producer of any capacity, irrespective of process route, starting their operations from iron making using iron ore, virgin or processed, with necessary refining facilities and rolling/processing facilities, at a single location or else in multiple locations provided that the entire gamut of iron & steel production, from iron making to finished steel production, is owned by the same company or its subsidiary company(ies). Provided that the iron making capacity is sufficiently matching the steel making capacity. Further, downstream units should use material from the upstream units of the same company or its subsidiaries. In case of non-availability of certain steel section/s i.e. Angle smaller than 100x100x10 mm, MS flats, rounds, square bars and chequered plate from primary steel producers, an option is given to the Main contractor to source these sections directly from SAIL
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

					Conversion/Wet Leasing agent subject to the conditions given at point no. A) below: A) Approval conditions for procurement of structural steel sections through SAIL Conversion/Wet Leasing agent: 1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for Owner supply. 2. Billets shall be procured from Owner approved Main Steel Producers. Proper records for traceability from raw material to final product shall be maintained. 3. 100% chemical analysis of the raw material (Billets) shall be carried out as per IS: 2830. Testing of one sample per 40 MT for each type of section or part thereof shall be carried out as per IS: 2062 on finished product. 4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC). MTC of finished sections shall be correlated with original MTC for Billets received from Main Steel Producer and Manufacturer Test Report of chemical analysis of Billets mentioned at point no.3. MTC of finished sections shall include the reference of MTC for Billets from Main Steel Producer. 5. Owner will have access to carry out the surveillance checks for in-process stage. 6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to Owner. In case of non-availability of certain size/s of steel tubes conforming to IS:1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from primary steel producers, the same may be sourced from BIS approved sources having valid BIS license subject to the conditions given at point no. B) below: B) Approval conditions for procurement of Steel tubes conforming to IS: 1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from BIS approved sources: 1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for Owner supply. 2. Raw materials shall be procured from Owner's approved Main Steel Producers.
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AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						3. 100% chemical analysis of the raw material (steel) shall be carried out as per IS: 228. Testing of samples of steel tubes and hollow sections from each lot shall be carried out as per IS: 1161 & IS: 4923 respectively on finished product. 4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC). 5. Owner will have access to carry out the surveillance checks for in-process stage. 6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to Owner. The specific methodology to be followed for procurement of Structural Steel and Reinforcement Bars through conversion route/BIS approved sources route shall be subject to approval by Owner in advance.												
53	Part B, Section – VI	Sub-section E-47, Civil Works	14 of 24	11.1.5.9	<table><tr><th>SL. NO.</th><th>TESTS/CHECKS</th><th>QUANTUM/STANDARD</th></tr><tr><td>2</td><td>Ultrasonic test on plates above 40mm</td><td>As per ASTM A435</td></tr></table>	SL. NO.	TESTS/CHECKS	QUANTUM/STANDARD	2	Ultrasonic test on plates above 40mm	As per ASTM A435	<table><tr><th>SL. NO.</th><th>TESTS/CHECKS</th><th>QUANTUM/STANDARD</th></tr><tr><td>2</td><td>Ultrasonic test on plates above 40mm</td><td>As per ASTM –A578 level B-S2</td></tr></table>	SL. NO.	TESTS/CHECKS	QUANTUM/STANDARD	2	Ultrasonic test on plates above 40mm	As per ASTM –A578 level B-S2
SL. NO.	TESTS/CHECKS	QUANTUM/STANDARD																
2	Ultrasonic test on plates above 40mm	As per ASTM A435																
SL. NO.	TESTS/CHECKS	QUANTUM/STANDARD																
2	Ultrasonic test on plates above 40mm	As per ASTM –A578 level B-S2																
54	Part B, Section – VI	Sub-section E-47, Civil Works	11 of 24	11.1.4 (last line of 5 th paragraph)	Sample test for 3% of the number of mechanical bars grips subject to a minimum of three, shall be carried out up to the yield strength of reinforcement of bars.	Deleted												

AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

55	Part C, Section – VI	GTR	37 of 89	9.02.23	All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub - contractor should meet the following. 1.The Contractor / Sub - contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub - contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization. Or In case the Contractor / Sub - contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure. <u>Elevated Temperature Test Cycle</u> During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service. During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C. In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement. <u>Burn in Test Cycle</u> The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.	1- Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be furnished for owner acceptance
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KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW)

TURBINE GENERATOR AND ASSOCIATED PACKAGES

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					The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time. During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable. During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.	
56	Part C, Section – VI	GTR		9.02.25 New clause added		<u>Software Reliability / Quality Certification</u> Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β-version and offered software is also free from all known bugs as on date of approval of systems documents by THDC as a part of quality documentation review and approval process during detail engineering.
57	VI/B	E-13	1-12		Generator & Auxiliaries QA requirement table rev-11	Generator & Auxiliaries QA requirement table rev-13(Attached)

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58	VI/B	A10	1 of 37	1.05.00	a) Centralized air conditioning system Control Rooms, Control Equipment Rooms, UPS & battery charger room, SWAS room, Water Analysis Lab, static excitation control room (if applicable) etc. in TG building. Dedicated AHUs shall be provided for each static excitation control room and shall be placed near to it.	a) Centralized air conditioning system Control Rooms, Control Equipment Rooms, UPS & battery charger room, SWAS room, Water Analysis Lab, static excitation control room (if applicable) etc. in TG building. Dedicated AHUs shall be provided for each static excitation control room and shall be placed near to it. Further, the equipment heat load of C&I systems/equipments (Employer's Scope) may be considered as follows: <table><tr><td>Sl. No.</td><td>Area</td><td>Equipment Heat Load</td></tr><tr><td>i.</td><td>CCR</td><td>20kW</td></tr><tr><td>ii.</td><td>CER at operating floor</td><td>72kW per unit</td></tr><tr><td>iii.</td><td>CER at mezzanine floor</td><td>27kW per unit</td></tr><tr><td>iv.</td><td>UPS & Battery Charger Room</td><td>54kW per unit</td></tr></table>	Sl. No.	Area	Equipment Heat Load	i.	CCR	20kW	ii.	CER at operating floor	72kW per unit	iii.	CER at mezzanine floor	27kW per unit	iv.	UPS & Battery Charger Room	54kW per unit
Sl. No.	Area	Equipment Heat Load																			
i.	CCR	20kW																			
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iii.	CER at mezzanine floor	27kW per unit																			
iv.	UPS & Battery Charger Room	54kW per unit																			
59	VI/B	A10	1 of 37	1.05.00	b) Centralized air conditioning system for Service Building: Various office areas, entrance lobbies, visitor & VIP lounge, reception area, simulator area , etc.	b) Centralized air conditioning system for Service Building: Various office areas, entrance lobbies, visitor & VIP lounge, reception area, etc.															
60	VI/B	A11	10 of 25	3.10.00	h) Where ever horizontal ducts are running outside supporting the duct work with the Employers beam & columns shall be provided by the bidder.	-----DELETED-----															
61	VI/B	A11	2 of 25	2.00.00	Note: Dry bulb temperature during summer season is 45.0 degC. The criteria which gives higher number of air changes/higher quantity of air of either of condition (Cl. 2 or 3) flow shall be selected.	Note: 1. Dry bulb temperature during summer season is 45.0 degC. The criteria which gives higher number of air changes/higher quantity of air of either of condition (Cl. 2 or 3) flow shall be selected. 2. To calculate air quantity based on air changes per hour (ACPH) method, height of operating floor (17M) in AB Bay shall be taken as 4 meter.															

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62	VI/B	A10	16 of 37	6.05.04 d)	Where the sheet metal double layer	Where the sheet metal double layer canvas or neoprene
		A11	9 of 25	3.10.00 c)	asbestos/canvas or neoprene coated fibre glass.	coated fibre glass.
		A10	35 of 37	Annexure-III	I. Data Sheet for Water Line Gate/Sluice Valves:	I. Data Sheet for Water Line Gate/Sluice Valves:
		A11	23 of 25	Annexure-III	I. Data Sheet for Water Line Gate Valves:	I. Data Sheet for Water Line Gate Valves:
		A10	36 of 37	Annexure-III	II. Data Sheet for Globe Valves:	II. Data Sheet for Globe Valves:
		A11	24 of 25	Annexure-III	II. Data Sheet for Globe Valves (as applicable):	II. Data Sheet for Globe Valves (as applicable):
		A10	37 of 37	Annexure-III 6.0	III. Data Sheet for Check Valves:	III. Data Sheet for Check Valves:
		A11	25 of 25	Annexure-III 6.0	III. Data Sheet for Check Valves:	III. Data Sheet for Check Valves:

AMENDMENT NO 20 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

	VI/B	A3	69 of 92	6.08.14	Operational Requirements: (a). Drive turbine of BFP (d) of running auxiliaries.	Operational Requirements: (a). Drive turbine of BFP (d) of running auxiliaries. (e) TDBFP center line elevation shall be such that the drains shall not be routed below zero meter elevation. Drain shall flow by gravity to turbine flash tank and there should not be any loop in the drain.
63	VI/B	A3	23 of 92	1.20.00 (h)	(h) Provide separate oil system with 100% redundant pumps, motors, accumulators and control cubicles etc. for both HP and LP bypass systems. Accumulators shall be sized to take sufficient number of stroking operations of all actuators under a condition of loss of oil supply from the pumps.	(h) Provide separate oil system with 100% redundant pumps, motors, accumulators and control cubicles etc. for both HP and LP bypass systems. Accumulators shall be sized to take sufficient number of stroking operations of all actuators under a condition of loss of oil supply from the pumps. Alternatively, Bidder may also provide common oil system with 100% redundant pumps, motors, accumulators and control cubicles etc. for HP and LP bypass systems. In case of common oil system, oil piping layout shall be as per recommendation of valve manufacturer and separate accumulators located nearer to respective valves shall be provided for HP and LP bypass system. Accumulators shall be sized to take sufficient number of stroking operations of all actuators under a condition of loss of oil supply from the pumps. Mandatory spares shall necessarily be supplied separately for both HP bypass oil system and LP bypass oil system as specified elsewhere in the specification.
64	VI/A	A0	6 of 13	Annexure-II	Annexure-II	Refer revised Appendix-II.

CLAUSE NO.		TECHNICAL REQUIREMENTS	
7.00.0	FOUNDATION SYSTEM AND GEOTECHNICAL DATA		
7.01.0	Soil Data Owner has carried out preliminary geotechnical investigation in the proposed area. Available bore logs of the area along with laboratory test results are enclosed at Annexure-C for Bidder's reference. The geotechnical investigation report of this area will be made available for the Bidder's study at the Owner's office, if required. However, Contractor, on his own cost, would have to conduct detailed investigations during execution to get the design data for carrying out foundation designs. No extra payment or claim for carrying out these additional investigations shall be entertained on this account. Based on the available bore logs, the soil stratum consists of sandy silt/clayey silt of low plasticity layer varying from 1.5m to 5m depth from ground level followed by silty sand/fine sand layer of thickness varying from 20m to 30m. This layer is underlain by about 5m layer of sandy silt followed by silty sand/fine sand layer up to the depth of investigation. The ground water table is encountered at about 4m depth at the time of investigation and may fluctuate with seasonal variation. Based upon the initial assessment, soil up to a depth of 5m to 6m (below existing ground level) is prone to liquefaction hazard. Suitable ground improvement as specified in subsequent clauses shall be carried out if open foundations (for lightly loaded structures) and pile foundation (for heavily loaded structures) are to be founded/cut-off-level (COL) of piles is to be kept in liquefiable zone. However, in case Contractor wants not to carry out ground improvement, minimum founding level/COL of piles shall be below 5m below NGL or below liquefiable zone whichever is deeper. For heavily loaded structures, pile foundations may be considered and for lightly loaded structures, suitable ground improvement as per clause 7.02.04 & 7.02.05 may be considered. Minimum cut off level below NGL is 5m. Onus of correct assessment/ interpretation and understanding of the existing subsoil condition / data is on the Bidder. Bidder may refer topographical survey drawing for variation in existing ground level (EGL) and FGL. As per topographical survey drawing, NGL is varying from RL(+) 191.5m to RL(+) 193.5m and FGL is RL(+) 194.0 i.e. there may be filling of 0.5m to 2.5m.		
7.01.01	Since the available geotechnical data is preliminary only, the Contractor shall carryout his own detailed geotechnical investigation for facilities under this package and shall be as per the scheme approved by Owner. The scheme for geotechnical investigation shall be as given at Clause 7.07.00 and shall be approved by Owner before execution. Geotechnical investigation work shall be got executed by the Contractor through the agencies as mentioned in Clause No. 7.07.03. However, no time extension shall be given on account of detailed geotechnical investigation carried out by the Contractor during execution. Bidder needs to consider the time required for detailed geotechnical investigation work in the L2 schedule which shall be binding on the Contractor during execution. The geotechnical investigation report shall be prepared with detailed recommendations regarding type of foundation and allowable bearing pressure/pile capacities for various structures/ facilities and other soil parameters. The report shall be submitted for Owner's approval incorporating all comments of owner, prior to commencement of design of foundation.		
7.01.02	The furnished borelog details are specific to the co-ordinates where the boreholes have been carried out and are provided for bidder's information only. Soil profile in the proposed area may vary with respect to the borelogs enclosed for bidder's		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment
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	information. Bidder has to consider all such variations in his estimation, over the extent of the work to be carried out. The Bidder should note that nothing extra whatsoever on account of variation between geotechnical data collected by Owner and that found by the Bidder during geotechnical investigation by him or during execution of works, shall be payable.				
7.01.03	Tank Foundations a) The tanks shall rest on flexible tank pad foundation, resting on sand with concrete ring wall to retain sand. Base of the concrete ring wall shall not rest on the expansive soil, if any. b) Entire loose/ soft soil inside the concrete ring wall shall be removed and shall be filled with sand. Sand for filling shall be clean and well graded conforming to IS 383 with grading Zone I to III. c) Sand shall be spread in layers not exceeding 30cm compacted thickness over the area. Each layer shall be uniformly compacted by mechanical means like plate vibrators, small vibratory rollers, etc to achieve a relative density of not less than 80%. d) Other requirements of tank foundations shall be as per IS 803 and as specified elsewhere in the specifications.				
7.02.00	Foundation System The requirements for the foundation system to be adopted are as given in subsequent clauses. Depending upon the depth of competent strata/stratum, type of structures, functional requirement of facility, extent of cutting / filling, suitable foundation, open or pile shall be adopted with approval of owner. For heavily loaded structures, pile foundations may be considered and for lightly loaded structures, suitable ground improvement may be considered.				
7.02.01	General Requirements a) All structures/equipment shall be supported either on suitable open foundations (isolated, combined, raft) or on pile foundation depending on type of structures/facilities, sub-strata, topography etc. b) The roads, ground floor slabs, trenches, pipe pedestals except thrust blocks, channels/drain and staircase foundation with foundation loading intensity less than 4 T / M² may be supported on open / shallow foundations resting on virgin / controlled compacted filled up soil. If the encountered sub-strata is black cotton soil, the same shall be either replaced upto the full depth or black cotton soil shall be stabilized by suitable treatment. For mitigation of liquefaction separate clause may be referred. c) No other foundation (other than as mentioned in (b) above and (h) below) shall rest on the filled up ground / soil. d) All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards.				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE</td><td>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371</td><td>SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment</td><td>PAGE 2 OF 13</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment	PAGE 2 OF 13
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7.02.02	e) Bidder shall also ensure that there is no damage to existing nearby foundations and the foundations pertaining to this package are not placed at shallower depth than the nearby foundations. If required depth of foundation is deeper than the existing foundations, proper protection shall be provided to existing foundations. f) The water table for design purpose shall be considered at Finished Ground Level. g) A combination of open and pile foundations shall not be permitted under the same equipment / structure / building. h) Foundation for miscellaneous equipment's on ground floor with sand backfilling. For equipments of static weight upto 1.5 T, the equipment may be supported on the ground floor slab by locally thickening the slab. Thickening of the ground floor slab shall be done upto an extent of about 0.6 m beyond the plan area of the equipment on all the sides. Further, the load intensity below the equipment shall be limited to 4T/m2. Other requirements of floor slab and compaction below the floor slab shall be adhered, as specified elsewhere in the specifications. For equipment's of static weight between 1.5 T and 20 T, the equipment may be supported on compacted sand filling with the load intensity below the equipment limited to 4T/m2. The minimum depth of foundation is 1.0m below FFL. Other requirements of sand compaction below the foundation shall be adhered, as specified elsewhere in the specifications. For equipment of static weight more than 20 T, the equipment foundation shall be taken to the founding level or shall be built up with PCC from the level as per approved report. The pedestal of equipment foundation or the foundation Block shall be isolated from the adjoining floor slab by providing bitumen impregnated fiber board of minimum 50 mm thick, conforming to IS: 1838 all around the equipment pedestal for the full depth of the floor slab.
	Open Foundations Following structures are to be placed on open foundation: Offsite buildings & structures, CPU, entire Transformer yard area enclosed between the peripheral road (except transformer foundations) and all other structures which are not founded on pile foundation are to be placed on open foundation and if the depth of foundation is less than 5.0/6.0m (as per approved report) below the EGL than the ground improvement shall be done using stone columns as per clause 7.02.04. In case open foundations are adopted, following shall be adhered to. a) The minimum width of foundation shall be 1.0 m. b) Minimum depth of foundation shall be 1.0m below Ground Level. c) It shall be ensured that all foundations of a particular structure/ buildings/ facility shall rest on one bearing stratum. d) Wherever the intended bearing sub-strata is virgin soil stratum but the actual stratum encountered during foundation excavation consists of filled up soil at founding level, under such cases either the foundation shall be lowered completely into the virgin
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	stratum or the filled up soil upto the virgin layers shall be removed and built up through PCC (1:4:8) up to designed foundation level. e) Wherever the intended bearing stratum is weathered rock, but the actual strata encountered during excavation consists of both overburden soil and weathered rock at founding level, under such cases, the overburden upto the weathered rock level including 0.5 m into the weathered rock shall be removed and built up through PCC (1:3:6) upto the designed founding level. Thus, maintaining the same founding level for all the footings of a structure. The treatment at the base of foundation before laying the PCC shall be carried out as per IS: 12070. f) The last layer of about 300 mm before reaching the founding level shall be excavated carefully by such equipment so that soil / rock at the required level will be left in its natural condition. g) If joints, fissures or other discontinuities in rock are encountered at founding level, then treatment of such rock defects shall be carried out as per IS: 13063-1991 in consultation with the Engineer. h) During design, the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. The ground improvement scheme shall be approved by owner before execution. Contractor, during execution, has to consider the geotechnical data required for design of foundation based on the detailed investigations to be carried out by them. An adequate factor of safety as per the Standards and also as per the industry practice shall be inbuilt in the civil design of foundations in order to cover up the risks of unforeseen conditions which may arise later. It is to be noted that no additional payment or claim of the Contractor, whatsoever, shall be admissible on account of variation in geotechnical parameters from the bid values, variation of foundation design and variation of construction methodology of foundation construction. For NGL of the proposed area GLP along with topographical survey drawing & borelog data may be referred. In case any loose/soft pockets is encountered at founding level, the same shall be removed completely upto the hard strata and filled up with PCC (1:4:8). i) For open foundations, the total permissible settlement shall be governed by IS: 1904 / IS: 13063 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following: <table><tr><td>Isolated & Raft (Main Power House, TG) resting on soil</td><td>25 mm</td></tr><tr><td>Isolated & Strip (other than Main Power House, TG) resting on soil</td><td>40 mm</td></tr><tr><td>Raft (other than Main Power House, TG) resting on soil</td><td>75 mm</td></tr></table> 7.02.03 Pile Foundations – In case piles are adopted, following shall be adhered to : Following structures are to be placed on pile foundation: Main Power house including Control room, TGs, Service Building, Transformer foundations, Pipe cable gallery, any other heavily loaded structure etc.	Isolated & Raft (Main Power House, TG) resting on soil	25 mm	Isolated & Strip (other than Main Power House, TG) resting on soil	40 mm	Raft (other than Main Power House, TG) resting on soil	75 mm
Isolated & Raft (Main Power House, TG) resting on soil	25 mm						
Isolated & Strip (other than Main Power House, TG) resting on soil	40 mm						
Raft (other than Main Power House, TG) resting on soil	75 mm						
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	i) pile foundation shall be of RCC, Cast-in-situ bored piles as per IS:2911. Pile boring shall be done using Rotary Hydraulic Rigs. Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer. If required, temporary or permanent MS liner may be provided for piling (ii) The minimum diameter of pile shall be 600 mm. The allowable load capacity of the pile in different modes (vertical compression, lateral and pullout) shall be based on the approved detailed geotechnical investigation tests to be carried out during design stage and shall be least of the two values i.e. as per approved geotechnical report and pile capacity achieved in pile load tests. It is to be noted that no additional payments or the claim of the Contractor, whatsoever, shall be admissible on account of variation in geotechnical parameters from the bid values, variation of foundation design and variation of construction methodology of foundation construction. iii) Only straight shaft piles shall be used. Minimum cast length of pile above cutoff level shall be 1.0 m. iv) The contractor shall furnish design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile in terms of measurable parameter, reinforcement for job as well as test piles, pile load test arrangement, locations of initial test piles etc.) for Engineer's approval. v) The piling work shall be carried out in accordance with IS:2911 (Relevant part) and accepted construction methodology. The construction methodology shall be submitted by the Contractor for Engineer's approval. vi) Number of initial load tests to be performed for each diameter and rated capacity of pile shall be subject to minimum as under. Vertical Lateral Minimum of 2 Nos. in each mode. Uplift vii) The initial pile load test shall be conducted with test load upto three times the pile capacity as finalized in (ii) above. In case of vertical compression test (initial test) the method of loading shall be cyclic as per IS:2911 (relevant part). viii) Load test shall be conducted at pile Cut-off Level (COL). If the water table is above the COL the test pit shall be kept dry throughout the test period by suitable de-watering methods. Alternatively the vertical load test may be conducted at a level higher than COL. In such a case, an annular space shall be created to remove the effect of skin friction above COL by providing an outer casing of suitable diameter larger than the pile diameter. ix) Number of routine pile load tests to be performed for each diameter/allowable capacity of pile shall be as under : i) Vertical : 0.5% of the total number of piles provided.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment	PAGE 5 OF 13

CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
	ii) Lateral : 0.5% of the total number of piles provided. x) The routine tests on piles shall be conducted upto test load of one and half times the allowable pile capacity. Piles for routine load tests shall be approved by the Employer. xi) In case, routine pile load test shows that the pile has not achieved the desired capacity or pile(s) have been rejected due to any other reason, then the Contractor shall install additional pile(s) as required and the pile cap design shall accordingly be reviewed and modified, if required. xii) Testing of piles and interpretation of pile load test results shall be carried out as per IS:2911 (Part-4). Contractor shall ensure that all the measuring equipment and instruments are properly calibrated at a reputed laboratory / institute prior to their use. Settlement / movement of the pile top shall be made by Linear Variable Differential Transducers (LVDT) having a least count of 0.01mm. xiii) The test load on initial test piles shall be applied by means of reaction from anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge with concrete blocks. xiv) Low Strain Pile Integrity test shall be conducted on all test piles and job piles. This test shall be used to identify the routine load test and not intended to replace the use of static load test. This test is limited to assess the imperfection of the pile shaft and shall be undertaken by an independent specialist agency to be approved by Engineering department of Owner. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM. xv) High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests. The procedure to carry out the test shall be submitted to the Engineer. The test and equipment shall conform to ASTM D4945-00. The test shall be conducted by an experienced independent test agency approved by the owner. Field data shall be submitted to the site engineer and shall include force velocity curves, pile capacity, simulated static load test curve, net and total pile displacement, pile integrity. A (Case pile wave analysis) CAPWAP or equivalent software analysis shall be conducted on the field data for correct capacity estimation and to evaluate end bearing and skin friction components of the pile. xvi) From load considerations, single pile may be used under a column/tower. In that case, pile shall be connected with tie beams at pile cut off level in both directions.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment	PAGE 6 OF 13

CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
	xvii) Contribution of frictional resistance of filled up soil if any, shall not be considered for computation of frictional resistance of piles. xviii) Reinforcement for job piles shall be designed as following: (a) Compression + bending piles: For these piles, the allowable safe pile capacities in compression and bending shall be considered. (b) Tension + bending piles: For these piles, the actual pile forces to be considered. However, maximum 3 types of combinations for varying percentage of tension capacity + bending case may be designed & adopted by contractor for the entire scope of work under this package.		
7.02.03	Ground Improvement below structures/facilities using stone columns: i) The work broadly involves installation of stone columns for mitigation of liquefaction hazard, improvement in bearing capacity of the soil and to bring down the residual settlements so that the facilities that may be constructed over the stone column area shall stand safely and perform satisfactorily throughout their lifetime. The stone columns shall be installed using bottom/top feed Vibroflotation techniques without water jetting i.e. dry method (displacement method) in accordance with these specifications. Installation of stone column by rammed/driven technique without water jetting may also be permitted/used subject to conforming to the specification and meeting to the construction schedule. In case of vibro replacement method, the bidder shall submit the construction methodology giving information regarding details of equipment, type and energy rating of vibratory probe, details of power output, compaction criteria etc. In case of rammed stone column methodology, the bidder shall submit the construction methodology giving information regarding type of equipment, weight of rammer, height of fall, compaction criteria, stages of casing withdrawal etc. Use of bentonite slurry for formation of stone columns shall not be permitted. A casing pipe shall be provided by the bidder upto to full depth of stone column. In either of the above techniques adopted, the parameters shall be so chosen to give stone column of specified diameter and load carrying capacity. In either of the above techniques adopted, the quantity of stones shall be placed in such that the column is filled in stages of height not exceeding 1m. Each stage shall be compacted to ensure uniform consumption of stones throughout the depth. The method of placement of stone shall be such that it is possible to measure the total consumption of stones in a column. Stone column installation procedure submitted by the bidder shall be approved by the Engineer. ii) All materials and workmanship shall be in accordance with this specification and IS: 15284: Part 1: 2003."Design and Construction for Ground Improvement – Guidelines, Part 1 Stone Columns". iii) Case:1 Ground improvement without piling provision after it		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment	PAGE 7 OF 13

CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
	Dia of column (D) = 900mm Spacing = 3D (Triangular pattern) Depth of ground improvement (d) = 6m Case:2 Ground improvement with piling provision after it Dia of column (D) = 900mm Spacing = 4D (Rectangular pattern) Depth of ground improvement (d) = 6m iv) Ground improvement with stone column shall be carried out minimum d/2 distance beyond the footprint of buildings(minimum 2 rows beyond the building footprint), where d is the depth of improvement. The ground improvement shall be carried out below the entire building/structure rather than restricting it to just below the foundations. v) Initial load tests shall be performed at the trial site as identified by Engineer to evaluate load settlement behaviour of the stone columns. These tests shall be conducted on a single as well as on a group of three columns. Load testing procedure, equipment and interpretation shall confirm to IS 15284 (Part-I). vi) Boreholes shall be drilled prior and after the installation of stone columns and frequency shall be minimum 1 borehole under each structure/facility or 2000 Sqm whichever is less. The performance of the stone column(s) shall be considered acceptable and approved by the Engineer based on the SPT 'N' values of the improved ground. The installation of stone column is considered acceptable if it achieve SPT 'N' value more than 15 from the natural ground level upto depth of improvement. The minimum load intensity after ground improvement shall be as mentioned in table-1 of this specification.		
7.02.05	Ground Improvement below roads & drains: In order to mitigate liquefaction below roads & drains, ground improvement by dynamic compaction or any other method can be done. The improvement shall be done along the alignment & additional d/2 distance on both sides away from the road/drain footprint, where d is depth of treatment. Boreholes shall be drilled prior and after the ground improvement and frequency shall be minimum 1 borehole under each structure/facility or 2000 Sqm whichever is less. The ground improvement is considered acceptable if it achieve SPT 'N' value more than 15 from the natural ground level upto depth of improvement. The minimum load intensity after ground improvement shall be 7T/m2. In case alignment of roads/drains changes at a later stage then the ground improvement using stone columns shall be done as per clause 7.02.04.		
7.03.00	Special Requirements		
7.03.01	Details of treatment for foundations / underground structures required to counteract soil / water chemical environment shall be as per detailed geotechnical investigation to be carried out by contractor. Contractor shall carry out chemical analysis during detailed geotechnical investigation and required treatment shall be provided accordingly.		
7.04.00	Excavation, Filling and Dewatering		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 				
7.04.01	For excavation works, comprehensive dewatering with well point or deep wells arrangement, if required, shall be adopted. Scheme for dewatering and design with all computations and back up data for dewatering shall be submitted for the owner's information. The water table shall be maintained at 0.5m below the founding depth.				
7.04.02	Excavation for shallow foundations shall be covered with PCC immediately after reaching the founding level. In case of any local loosening of soil or any loose pockets are encountered at founding level during excavation the same shall be removed and compensated by PCC M7.5. The final layer of about 300 mm thickness above the founding level shall be excavated by suitable means, so as to avoid disturbance to founding stratum.				
7.04.03	Backfilling in Main Power House and TG This clause is applicable in the following areas: a) Main Power House Building foundations including Auxiliary column foundations, TG foundations, BFP foundations, CW pit, CEP Pit. b) Common control room building foundations (between the Main Power House Buildings) After construction of foundations for above mentioned buildings/ facilities, excavated earth between the excavation profile and the foundations, wherever backfilling is required, shall be backfilled with sand from founding level till finished ground level. In case block excavation is carried out for the above mentioned areas, after construction of foundations, whole area shall be backfilled with sand from founding level till finished ground level. Sand used for filling shall be natural sand/manufactured sand, and clean & well graded conforming to IS 383 with grading Zone I to III. Backfilling with sand shall be carried out in layers not exceeding 300 mm compacted thickness and each layer shall be compacted to minimum 80% of relative density. Backfilling in other area Backfilling around foundations, pipes, trenches, sumps, pits, plinths, etc. shall be carried out with approved material in layers not exceeding 300 mm compacted thickness (higher thickness of layers upto 500mm with heavy mechanical compacting equipment) and each layer shall be compacted to 90% of standard proctor density for cohesive soils and to 80% of relative density for non cohesive soils. In any case, black cotton soil shall not be used in back filling without providing cushion of 1m of non expansive cohesive soil/moorum around the footings. In case of roads in the area of black cotton soil, minimum 0.4m moorum shall be provided. Rock pieces having size less than 150 mm and interstices filled with soil may be used for backfilling around foundation, plinths etc. and shall be compacted to minimum of 85% of original stack of material after filling the interstices.				
7.04.04	Founding level for trenches/channels shall be decided as per functional requirement. The bottom of excavation shall be properly compacted prior to casting of bottom slab of trenches / channels.				
7.04.05	CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed upto the formation level.				
7.04.06	The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding of material or article from any bank or side of such excavation which is more				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE</td><td>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371</td><td>SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment</td><td>PAGE 9 OF 13</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment	PAGE 9 OF 13
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
	than one and a half meter above the footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.		
7.05.00	Excavation in Rock- NA Excavation in rock shall be carried out by mechanical means and if blasting is required for founding of some of the structures under this package, control blasting only shall be carried out.		
7.06.00	Sheeting & Shoring The contractor shall ascertain for himself the nature of materials to be excavated and difficulties, if any, likely to be encountered in excavation while executing the work. Sheet piling, sheeting and shoring, bracing and maintaining suitable slopes, drainage, etc. shall be provided and installed by the Contractor, to the satisfaction of the Engineer.		
7.07.00	Geotechnical Investigation The Contractor shall carry out detailed geotechnical investigation in the areas under his scope for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Contractor shall obtain the approval for the field testing scheme proposed by him from the Owner before undertaking the geotechnical investigation work.		
7.07.01.00	Scheme of geotechnical Investigation		
7.07.02.01	Field test shall include but not be limited to the following: Boreholes, Standard Penetration Test (SPT), Dynamic Cone Penetration Test (DCPT), collection of disturbed samples (DS) and undisturbed soil samples (UDS), Trial Pits (TP), Plate Load Tests (PLT), Electrical Resistivity Test (ERT), Cross hole shear test (CHST), Pressuremeter test (PMT) In situ field permeability tests, collection of water samples, etc.		
7.07.02.02	The diameter of borehole shall be minimum 150 mm in soil and 76 mm in rock. The diameter of UDS sampler shall be 100 mm minimum. Core drilling in rock shall be done by using hydraulically feed rotary drill & double tube core barrel with diamond bit.		
7.07.02.03	The minimum tests are indicated in Clause No. 7.08.00. Adequate number of tests shall be conducted up to sufficient depth for complete determination of subsoil conditions. The depth of boreholes shall be as specified in Appendix A. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20%, met within a borehole. This test shall be conducted at every 3.0 m interval or at change of strata, up to the final depth. SPT 'N' of 100 and above shall be referred as refusal. UDS shall be collected at every 3.0 m interval or at change of strata up to depth of borehole. UDS may be replaced by additional SPT, if SPT'N' value in the strata is above 50.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371	SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 										
7.07.02.04	Laboratory tests shall be done as per relevant IS codes. The laboratory tests, not be limited to the following shall be conducted on disturbed and undisturbed soil samples, rock samples & water samples collected during field investigations in sufficient numbers. Laboratory Tests on Soil Samples Laboratory tests shall be carried out on disturbed and undisturbed soil samples for Grain Size Analysis, Hydrometer Analysis, Atterberg Limits, Triaxial Shear Tests (UU), Natural Moisture Content, Specific Gravity and Bulk Unit Weight, Consolidation Tests, Unconfined Compression Test, Free swell Index, Shrinkage Limit, Swell Pressure Test, Chemical Analysis test on soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, organic matter and any other chemicals harmful to concrete and reinforcement/ steel.										
7.07.02.05	Geotechnical investigation (field & laboratory) shall be carried out in accordance with the provisions of relevant Indian Standards. On completion of all field & laboratory work, geotechnical investigation report shall be submitted for Owner's review/approval. The Geotechnical investigation report shall contain geological information of the region, procedure adopted for investigation, field & laboratory observations/ data/ records, analysis of results & recommendations on type of foundation for different type of structures envisaged for all areas of work with supporting calculations. Recommendations on treatment for soil, foundation, based on subsoil characteristics, soft soils, aggressive chemicals, expansive soils, etc. Recommendations on foundation system and the net allowable bearing pressures and pile capacity shall be based on the conservative values of geotechnical investigation data.										
7.07.03.00	Geotechnical investigation work shall be got executed by the Contractor through the following agencies. 1. C.E.TESTING COMPANY Pvt. Ltd, Kolkata 2. Cengrs Geotechnica Pvt. Ltd, New Delhi 3. M.K. Soil Testing Laboratory, Ahemdabad 4. KCT Consultancy Services, Ahemdabad										
7.08.00	Geotechnical Investigation Scheme a) Boreholes (Minimum) <table><tr><th>S.No</th><th>Structure</th><th>Spacing/Number of borehole</th><th>Depth of borehole</th><th>Remarks</th></tr><tr><td>1</td><td>Main power house, Turbo-Generator (TG)</td><td>35 to 45 m along the rows of main power house columns. Minimum 2 nos. boreholes under each TG</td><td>Depth of boreholes shall be 45 to 55m.</td><td>Depth of boreholes shall be as mentioned in column "Depth of</td></tr></table>	S.No	Structure	Spacing/Number of borehole	Depth of borehole	Remarks	1	Main power house, Turbo-Generator (TG)	35 to 45 m along the rows of main power house columns. Minimum 2 nos. boreholes under each TG	Depth of boreholes shall be 45 to 55m.	Depth of boreholes shall be as mentioned in column "Depth of
S.No	Structure	Spacing/Number of borehole	Depth of borehole	Remarks							
1	Main power house, Turbo-Generator (TG)	35 to 45 m along the rows of main power house columns. Minimum 2 nos. boreholes under each TG	Depth of boreholes shall be 45 to 55m.	Depth of boreholes shall be as mentioned in column "Depth of							
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) STEAM TURBINE GENERATOR ISLAND PACKAGE TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. THDC/RKSH/CC-371 SUB-SECTION-D-01 CIVIL WORKS Annexure-I to Amendment PAGE 11 OF 13											

2	Service building	Minimum 3 nos. of boreholes	40 to 55 m	Borehole" or 5m continuous in rock with RQD > 50% whichever is earlier.
3	Transformer yard area	Minimum 8 nos. boreholes and 8 nos. of ERT	40 to 50 m	
4	Control room building	Minimum 3 nos. of boreholes, 3 Nos. ERT	40 to 55 m	
5	CPU	Minimum 2 nos. boreholes	25 to 35 m	
6	Condensate storage tank foundation.	3 Nos. boreholes, 3 Nos. ERT and 1 no PLT	25 to 35 m	
7	Pipe cable gallery	1 borehole @ 200m c/c spacing	40 to 55 m	
8	Other Structure/Facility	Minimum 2 Nos. boreholes under each area / facility	25 to 50 m	

b) Other Field Tests (Minimum)

1	Plate Load Test (PLT)	Minimum 4 Nos	Test Depth from 2 to 4 m	
2	Cyclic Plate Load Test (CPLT)	1 no in each TG	Test Depth from 2 to 4 m	
3	Trial Pit (TP)	About 10 Nos.	Depth upto 4 m	
4	In Situ Permeability Test In Boreholes	In minimum 8 Nos. of boreholes	Tests shall be conducted at depths of 1.0m, 3.0m, 5.0m, 8.0m and 12.0m.	
5	DCPT	About 10-20% of boreholes up to refusal depth		

6	ERT	10 Nos other structures		
7	CROSS HOLE	1No. in each TG	Depths covering from 1.0 m to 25.0 m	
8	PMT	30 no of tests in main power house area	Depths covering from 1.0 m to 25.0 m	

- Depth and location of Boreholes and other field tests (DCPT, PLT, CPLT, CROSS HOLE TEST, PMT, TP, ERT, field permeability tests etc.) shall be approved by Owner before execution of geotechnical investigation work.
- Investigation in any other building / structure / facilities / trestles which are not mentioned above shall also be carried out, if required, by the bidder for the facilities under his scope.

Annexure-II

TABLE –B
INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
1.	Main power house Building.			
	a) Unloading Bay	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Cable vault	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	c) Balance area including passage	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	d) SWAS Room	Vitrified ceramic tiles.	Acrylic emulsion paint.	Aluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	e) Equipment Area, ESP SWGR/ ACP Room/ UAF Room	Cement concrete with Metallic hardener topping	Acrylic distemper.	Acrylic distemper (except metal deck area)
	f) UPS Battery charger room	Vitrified ceramic tiles.	Aluminium composite panel cladding	Aluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	g) Deaerator floor	Cement concrete with Metallic hardener topping.		-
	h) Operating Floor	20 mm thick heavy duty anti skid full body vitrified tile.	Colour coated Metal cladding on A-Row& Gable end, up to crane girder level.	Metal deck roofing (bottom of sheeting with RAL 9002 finish)

Annexure-II

TABLE –B
INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	i) General circulation and movement areas	18mm thk. Polished granite honed finish combination as per design stone / marble stone/ Vitrified Ceramic tiles.		Acrylic distemper (except metal deck area).
	j) Switchgear room	Cement concrete with Metallic hardener topping.	Acrylic distemper	Acrylic distemper (except metal deck area)
	k) MCC Room	Cement concrete with Metallic hardener topping.	Acrylic distemper	Acrylic distemper (except metal deck area)
	l) Control room area including control room, computer room,	Matt Finish Vitrified ceramic tiles	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	m) Control equipment room,	Matt finish Vitrified ceramic tiles (Matt Finish) Partition	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	n) Conference room, senior executive room.	Matt finish Vitrified ceramic tiles (Matt Finish)	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design

Annexure-II

TABLE –B
INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	o) Record room	Ceramic Tiles	Acrylic distemper.	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	p) Locker room	Ceramic Tiles	Acrylic Emulsion Paint	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	q) Toilet area	Ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Calcium Silicate false ceiling.
	r) Office Room, Staff Room	Vitrified ceramic tiles.	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	s) Laboratory area	Vitrified Ceramic / Acid/alkali resistant tiles.	Designer ceramic wall tiles up to False Ceiling Height/ Aluminium composite panel cladding for columns and walls in case of A.C Panel	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	t) RCC Stair case	18mm thick Granite (Polished and honed Finished) stone	Polished Granite Stone up to 1.2m. ht. & Acrylic Distemper Paint over wall putty finish for balance height.	Acrylic Distemper

Annexure-II

TABLE –B
INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	u) Lift and Staircase Lobby	18mm thick polished granite stone as pattern.	18mm thick polished granite & glass mosaic tile cladding up to False Ceiling Height	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	v) Passages and general circulation areas.	18mm thick polished Marble Stone/ granite stone.	Acrylic Distemper / acrylic emulsion paint.	-
	w) Battery Room	Acid and alkali resistant tile.	Acid and alkali resistant tile up to 1.2m height and chemical resistant paint for balance height	Chemical Resistant paint except in locations where Metal deck has been provided
	x) Oil canal, oil room, oil purification Tank and other areas where oil spillage is likely to occur.	Oil resistant paint (epoxy based) 150 micron over primer.	As above except oil canal Oil resistant Paint	As above except oil canal.
	y) Pathways including roof area.	22mm thick concrete chequered tiles.	-	-
2.	Service Building			
	a) Entrance Lobbies and Lift areas/Foyer/Exhibition space.	18mm thick polished granite stone as/ pattern.	Textured paint /18mm thick polished granite cladding/lacquered glass cladding and glass mosaic tile murals in lift lobby & foyer	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design

Annexure-II

TABLE –B
INTERIOR FINISHING SCHEDULE

S.NO.	DESCRIPTION OF AREA	FLOORING	WALLING	CEILING
	b) Conference room, senior executive room.	11 mm thk. Laminated wooden flooring	Glazed partition with Aluminium frame/ Acrylic emulsion paint.	Mineral fiber board false ceiling in combination with GRG plaster board border in column depth or as per approved design.
	c) Office Room, Staff Room/Library/Canteen.	Digitally glazed Vitrified ceramic tiles.	Acrylic emulsion paint./ Designer Glass mosaic tile mural in combination with textured paint in Canteen	Mineral fiber board false ceiling in combination with GRG plaster board border in column depth or as per approved design
	d) Passage	Digitally glazed Vitrified ceramic tiles.	Acrylic emulsion paint.	Aluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	e) RCC Stair case	18mm thick Granite (Polished and Flame Finished) stone	Glass Mosaic Tile cladding in murals and pattern	Acrylic Distemper.
	f) Toilet/ Pantry/ Kitchen	Ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Acrylic distemper in kitchen / Calcium Silicate false ceiling in toilet and pantry
	g) AHU/ A.C. Plant room/MCC Room/Store	Cement concrete with Metallic hardener topping.	Acrylic distemper	Acrylic distemper
	h) Covered parking area	Pavers interlocking cement concrete blocks.	-	-
	i) Pathways including roof area.	22mm thick concrete chequered tiles.		

Annexure-II

- Note :
1. All wall above false ceiling shall also be plastered.
 2. The colour and pattern of finish shall be as per approved details.
 3. All materials shall be of reputed and established brand approved by Engineer-in-charge.
 4. Wherever alternative materials are specified, the final selection rests with Engineer-in-charge.
 5. This finishing schedule shall also be applicable to similar functional areas for all other buildings and facilities.
 6. All the finishing materials shall be applied/provided as per manufacturer specification and guidelines under the supervision & guidelines of manufacturer.
 7. Requirement given above are suggestive and minimum. Bidder is welcome to suggest alternative scheme conforming to design functional requirement subject to approval of the Engineer-in-charge.



ISO/IEC 17025:2005
Certified Laboratory
(NABL)
Certificate No. T-1741



Location : Khurja, U.P.
UTM Coordinates : 785926 E, 3118909 N

Soil Profile (BH-4)

Termination Depth : 35.45 m (m)
Ground Water Depth : 5.50 m
Boring Method : Shell & Auger
Casing Depth : 32.0 m
Boring Start : 07-Jan-18
Boring Finish : 08-Jan-18

Depth, m		Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
From	To		Field Value, N _r	Corrected Value, N"				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, φ (degrees)	
0.00	0.50	DS1				Stiff grey sandy with gravels, low plastic (CL)																	
1.00	1.45	UDS1						16	23	55	6	29.4	18.0	11.4	1.89	1.67	12.6		UC		1.2		
2.00	2.45	SPT1	8	11																			
4.00	4.45	UDS2					5.00								1.89	1.67	13.2		DS	0.5 , 1, 1.5	0.0	32.4	
5.00	5.45	SPT2	14	15		Medium dense grey silty fine sand (SM)	7.00	0	84	16	0							2.67					
7.00	7.45	DS2				Medium dense to dense grey fine sand (SP-SM)																	
8.00	8.45	SPT3	17	16		- medium dense, 7.0 to 14.0 m																	
10.00	10.45	DS3																					
11.00	11.45	SPT4	23	21																			
13.00	13.45	DS4						0	92	8	0												
14.00	14.45	SPT5	36	31		- dense, 14.0 to 16.5 m																	
16.00	16.45	DS5					17.00																

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-4)



Location : Khurja, U.P.
UTM Coordinates : 785926 E, 3118909 N
Certificate No. T-1741

Boring Method : Shell & Auger
Casing Depth : 32.0 m
Boring Start : 07-Jan-18
Boring Finish : 08-Jan-18

Termination Depth : 35.45 m (m)
Ground Water Depth : 5.50 m

Depth, m		Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
From	To		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
17.00	17.45	SPT6	45	36		Dense to very dense brown silty fine sand (SM) - dense, 17.0 to 23.0 m		0	84	16	0				2.00	1.75	14.5						
19.00	19.45	DS6																					
20.00	20.45	SPT7	48	36																			
22.00	22.24	UDS3																					
23.00	23.45	SPT8	59	42		- very dense, 23.0 to 29.0 m																	
25.00	25.45	DS7																					
26.00	26.35	SPT9	100/20cm	-		- dense, 29.0 to 32.0 m																	
28.00	28.45	DS8																					
29.00	29.45	SPT10	34	22		- very dense, 32.0 to 34.5 m																	
31.00	31.45	DS9																					
32.00	32.45	SPT11	57	35																			
34.00	34.45	DS10																					

⁽¹⁾ SPT is outside NABL scope.

Boring Finish : 08-Jan-18

[illegible]



Soil Profile (BH-6)



ISO/IEC 17025:2005
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Certificate No. T-1741

Location : Khurja, U.P.
UTM Coordinates : 785940 E, 3118715 N

Boring Method : Shell & Auger
Casing Depth : 48.5 m
Boring Start : 10-Jan-18
Boring Finish : 12-Jan-18

Termination Depth : 50.32 m (m)
Ground Water Depth : 5.80 m

Depth, m		Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
From	To		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
0.00	1.00	DS1				Stiff brown sandy silt with gravels, low plastic (CL)	4.00	5	40	48	7				1.90	1.71	11.0						
1.00	1.45	UDS1																					
2.00	2.45	SPT1	10	13																			
4.00	4.45	UDS2				Medium dense brown silty fine sand (SM)									1.93	1.67	16.1						
5.00	5.45	SPT2	18	19				0	83	17	0	1											
7.00	8.00	DS2																					
8.00	8.45	SPT3	15	14																			
10.00	11.00	DS3																					
11.00	11.45	SPT4	15	13																			
13.00	14.00	DS4																					
14.00	14.45	SPT5	12	10				0	80	20	0												
16.00	16.45	DS5																					

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-6)



ISO/IEC 17025:2005
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(NABL)
Certificate No. T-1741

Location : Khurja, U.P.
UTM Coordinates : 785940 E, 3118715 N

Boring Method : Shell & Auger
Casing Depth : 48.5 m
Boring Start : 10-Jan-18
Boring Finish : 12-Jan-18

Depth, m	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
17.00	17.45	SPT6	35	28	Dense brown silty fine sand (SM)	17.50																
17.50	17.70	DS6			Hard brown silty clay, high plastic (CH)	19.00																
19.00	20.00	DS7			Dense to very dense grey fine sand (SP-SM)																	
20.00	20.45	SPT7	38	29	- dense, 19.0 to 26.0 m		0	94	6	0												
22.00	22.35	UDS3																				
23.00	23.45	SPT8	33	24																		
25.00	25.50	DS8																				
26.00	26.45	SPT9	64	43	- very dense, 26.0 to 29.0 m																	
28.00	29.00	DS9																				
29.00	29.45	SPT10	38	24	- dense, 29.0 to 32.0 m																	
31.00	32.00	DS10																				
32.00	32.45	SPT11	60	37	- very dense, 32.0 to 34.0 m																	

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-6)



ISO/IEC 17025:2005
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Certificate No. T-1741

Location : Khurja, U.P.
UTM Coordinates : 785940 E, 3118715 N

Boring Method : Shell & Auger
Casing Depth : 48.5 m
Boring Start : 10-Jan-18
Boring Finish : 12-Jan-18

Termination Depth : 50.32 m (m)
Ground Water Depth : 5.80 m

Depth, m		Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
From	To		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
34.00	35.00	DS11				Very dense grey fine sand (SP-SM)	41.00																
35.00	35.45	SPT12	51	30																			
37.00	38.00	DS12																					
38.00	38.45	SPT13	73	41																			
40.00	40.45	DS13																					
41.00	41.35	SPT14	109/ 20cm	-		Very dense brown silty fine sand (SM)		0	80	20	0												
43.00	44.00	DS14																					
44.00	44.31	SPT15	103/ 16cm	-																			
46.00	47.00	DS15																					
47.00	47.35	SPT16	101/ 20cm	-																			
49.00	50.00	DS16																					
50.00	50.32	SPT17	107/ 17cm	-			50.32																

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-8)



ISO/IEC 17025:2005
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Certificate No. T-1741

Location : Khurja, U.P.
UTM Coordinates : 785864 E, 3118907 N

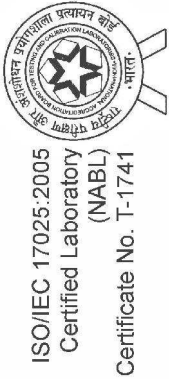
Boring Method : Shell & Auger
Casing Depth : 37.5 m
Boring Start : 13-Jan-18
Boring Finish : 15-Jan-18

Depth, m		Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
From	To		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
0.00	1.00	DS1				Stiff brown sandy silt, low plastic (CL)	7.00																
1.00	1.45	SPT1	8	12																			
2.00	2.45	UDS1																					
4.00	4.45	SPT2	11	12																			
5.00	5.45	UDS2																					
7.00	7.45	SPT3	11	11		Medium dense brown silty fine sand (SM)	17.00	0	86	14	0				1.84	1.65	11.6						
8.00	9.00	DS2																					
10.00	10.45	SPT4	13	12					0	79	21	0											
11.00	12.00	DS3																					
13.00	13.45	SPT5	20	17																			
14.00	15.00	DS4								0	81	19	0										
16.00	16.45	SPT6	27	22																			

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-8)



ISO/IEC 17025:2005
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Certificate No. T-1741

Location : Khurja, U.P.
UTM Coordinates : 785864 E, 3118907 N

Termination Depth : 40.45 m (m)
Ground Water Depth : 5.85 m

Boring Method : Shell & Auger
Casing Depth : 37.5 m
Boring Start : 13-Jan-18
Boring Finish : 15-Jan-18

Depth, m	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
17.00	18.00	DS5			Dense to very dense grey fine sand (SP-SM) - dense, 17.0 to 25.0 m - with traces of gravel, 17.0 to 32.0 m - very dense, 25.0 to 35.0 m		3	88	9	0												
19.00	19.45	SPT7	25																			
20.00	21.00	DS6																				
22.00	22.45	SPT8	30																			
23.00	24.00	DS7																				
25.00	25.45	SPT9	39																			
26.00	27.00	DS8																				
28.00	28.45	SPT10	48																			
29.00	30.00	DS9																				
31.00	31.45	SPT11	42																			
32.00	33.00	DS10																				
34.00	34.45	SPT12	42				0	92	8	0												

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-8)



Location : Khurja, U.P.
UTM Coordinates : 785864 E, 3118907 N
Certificate No. T-1741

Termination Depth : 40.45 m (m)
Ground Water Depth : 5.85 m

Boring Method : Shell & Auger
Casing Depth : 37.5 m
Boring Start : 13-Jan-18
Boring Finish : 15-Jan-18

Depth, m	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
35.00	36.00 DS11				Very dense grey fine sand (SP-SM)	40.45																
37.00	37.45 SPT13	81	46																			
38.00	39.00 DS12																					
40.00	40.45 SPT14	98	53																			

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-9)



ISO/IEC 17025:2005
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Certificate No. T-1741

Location : Khurja, U.P.
UTM Coordinates : 785846 E, 3118762 N

Boring Method : Shell & Auger
Casing Depth : 46.0 m
Boring Start : 04-Jan-18
Boring Finish : 08-Jan-18

Depth, m		Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
From	To		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
0.00	0.50	DS1																2.68					
1.00	1.45	SPT1	9	14		Loose to medium dense grey silty fine sand (SM)																	
2.00	2.45	UDS1				- loose, 0.0 to 3.0 m																	
3.00	3.45	SPT2	16	19		- medium dense, 3.0 to 6.0 m			81	19	0				1.86	1.72	8.4		DS	0.5, 1, 1.5	0.0	36.0	
5.00	5.45	UDS2					6.00																
6.00	6.45	SPT3	23	24		Medium dense grey fine sand (SP-SM)			94	6	0												
8.00	8.45	DS2																					
9.00	9.45	SPT4	25	24																			
11.00	11.45	DS3																					
12.00	12.45	SPT5	18	16			14.00																
14.00	14.45	DS4				Medium dense brown silty fine sand with traces of gravel (SM)		4	81	15	0												
15.00	15.45	SPT6	22	19			17.00																

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-9)



ISO/IEC 17025:2005
Certified Laboratory
(NABL)
Certificate No. T-1741

Location : Khurja, U.P.

UTM Coordinates : 785846 E, 3118762 N

Termination Depth : 50.43 m (m)

Ground Water Depth : 5.00 m

Boring Method : Shell & Auger

Casing Depth : 46.0 m

Boring Start : 04-Jan-18

Boring Finish : 08-Jan-18

Depth, m	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
17.00	DS5																					
18.00	SPT7	20	16		Medium dense grey fine sand (SP-SM)	21.00																
20.00	DS6																					
21.00	SPT8	36	27		Hard brown sandy silt; low plastic (CL)	23.00																
23.00	DS7																					
24.00	SPT9	44	31		Dense to very dense grey fine sand (SP-SM)																	
26.00	DS8				- dense, 24.0 to 27.0 m																	
27.00	SPT10	62	42		- very dense, 27.0 to 33.0 m																	
29.00	DS9																					
30.00	SPT11	65	42																			
32.00	DS10																					
33.00	SPT12	45	28		- dense, 33.0 to 33.5 m																	

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-9)



ISO/IEC 17025:2005
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Certificate No. T-1741

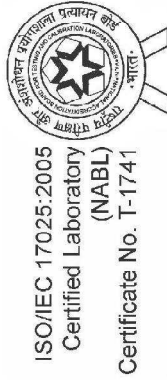
Location : Khurja, U.P.
UTM Coordinates : 785846 E, 3118762 N

Termination Depth : 50.43 m (m)
Ground Water Depth : 5.00 m

Boring Method : Shell & Auger
Casing Depth : 46.0 m
Boring Start : 04-Jan-18
Boring Finish : 08-Jan-18

Depth, m	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)	Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
35.00	35.45	DS11			Very dense grey fine sand (SP-SM)	36.00								2.06	1.84	12.1						
36.00	36.45	SPT13	84	49	Hard brown sandy silt; low plastic (CL)	38.00																
38.00	38.45	DS12			Very dense grey fine sand (SP-SM)	50.43																
39.00	39.42	SPT14	104/27cm	-																		
41.00	41.45	DS13																				
42.00	42.40	SPT15	105/25cm	-																		
44.00	44.45	DS14																				
45.00	45.35	SPT16	102/20cm	-																		
47.00	47.45	DS15																				
48.00	48.45	SPT17	80	39																		
50.00	50.43	SPT18	102/28cm	-																		

⁽¹⁾ SPT is outside NABL scope.



Soil Profile (BH-3)

ISO/IEC 17025:2005
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Certificate No. T-1741

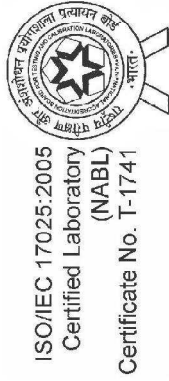
Location : Area-1
UTM Coordinates : 786019 E, 3118803 N

Termination Depth : 50.32 m
Ground Water Depth : 5.70 m

Boring Method : Shell & Auger
Casing Depth : 46.4 m
Boring Start : 07-Feb-18
Boring Finish : 11-Feb-18

Depth, m	To From	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
			Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
0.00	1.00	DS1																		UC				0
1.00	1.45	UDS1																						
2.50	2.95	SPT1	12	15			5.50	0	38	53	9	25.0	16.4	8.6		2.01	1.68	19.5			0.8			
4.00	4.45	UDS2																						
5.50	5.95	SPT2	17	17																				
7.00	7.45	UDS3					8.50	2	83	15										DS	0.5, 1, 1.5	0.0	30.9	
8.50	8.95	SPT3	20	19																				
10.00	10.33	UDS4																						
11.50	11.95	SPT4	27	24																				
13.00	13.26	UDS5																						
14.50	14.95	SPT5	29	24												2.01	1.67	20.5		DS	0.5, 1, 1.5	0.0	33.7	
16.00	16.50	DS2																						

⁽¹⁾ SPT is outside NABL scope



Soil Profile (BH-3)

ISO/IEC 17025:2005
Certified Laboratory
(NABL)
Certificate No. T-1741

Location : Area-1
UTM Coordinates : 786019 E, 3118803 N

Termination Depth : 50.32 m
Ground Water Depth : 5.70 m

Boring Method : Shell & Auger
Casing Depth : 46.4 m
Boring Start : 07-Feb-18
Boring Finish : 11-Feb-18

Depth, m	To From	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
			Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
17.50	17.90	SPT6	100/25cm	-		Very dense grey fine sand (SP-SM)	20.50																	
19.00	19.45	UDS6																						
20.50	20.95	SPT7	52	39		Hard brown sandy silt, low plastic (CL)	22.00																	
22.00	22.21	UDS7				Very dense grey silty fine sand (SM)	23.50	0	70	28	2		31.2	21.4	9.8									
23.50	23.95	SPT8	83	59		Very dense grey fine sand (SP-SM)																		
25.00	25.50	DS3																						
26.50	26.89	SPT9	100/24cm	-																				
28.00	28.50	DS4																						
29.50	29.95	SPT10	102	65																				
31.00	31.50	DS5																						
32.50	32.90	SPT11	100/25cm	-																				
34.00	34.50	DS6																						

⁽¹⁾ SPT is outside NABL scope



Soil Profile (BH-3)

ISO/IEC 17025:2005
Certified Laboratory
(NABL)
Certificate No. T-1741

Location : Area-1

UTM Coordinates : 786019 E, 3118803 N

Termination Depth : 50.32 m

Ground Water Depth : 5.70 m

Boring Method : Shell & Auger

Casing Depth : 46.4 m

Boring Start : 07-Feb-18

Boring Finish : 11-Feb-18

Depth, m	To From	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
			Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
35.50	35.88	SPT12	100/23cm	-		Very dense grey fine sand (SP-SM)	50.32																	
37.00	37.50	DS7																						
38.50	38.88	SPT13	102/23cm	-																				
40.00	40.50	DS8																						
41.50	41.86	SPT14	101/21cm	-																				
43.00	43.50	DS9																						
44.50	44.85	SPT15	102/20cm	-																				
46.00	46.50	DS10																						
47.50	47.83	SPT16	101/10cm	-																				
49.00	49.50	DS11																						
50.00	50.32	SPT17	100/17cm	-																				

⁽¹⁾ SPT is outside NABL scope



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Certificate No. T-1741

Soil Profile (BH-21)

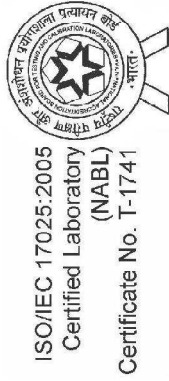
Location : Area-2
UTM Coordinates : 786024 E, 3118574 N

Boring Method : Shell & Auger
Casing Depth : 33.5 m
Boring Start : 21-Feb-18
Boring Finish : 22-Feb-18

Termination Depth : 35.45 m
Ground Water Depth : 6.00 m

Depth, m	To	From	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
				Field Value, N _p	Corrected Value, N _p				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, c ² (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
0.00	0.50	DS1	DS1	14	18		Stiff grey clayey silt, medium plastic (CI)	4.00	0	8	74	18	35.3	23.1	12.2		1.77	1.66	6.8		UC		2.0		
1.00	1.45	UDS1	UDS1																						
2.50	2.95	SPT1	SPT1	11	11		Stiff grey sandy silt, low plastic (CL)	7.00	0	17	70	13					1.90	1.74	9.4	2.67	DS	0.5 ¹ , 1.5	0.0	34.9	
4.00	4.45	UDS2	UDS2																						
5.50	5.95	SPT2	SPT2	16	15		Medium dense grey silty fine sand (SM)		0	66	32	2					1.96	1.68	16.7						
7.00	7.45	UDS3	UDS3																						
8.50	8.95	SPT3	SPT3	22	19		Medium dense grey fine sand (SP-SM)	11.50	0	56	41	3					1.99	1.73	14.9		DS	0.5 ¹ , 1.5	0.0	31.5	
10.00	10.45	UDS4	UDS4																						
11.50	11.95	SPT4	SPT4	28	23		- with traces of gravel, 14.5 to 16.0 m		2	88	10	0													
13.00	13.50	DS2	DS2																						
14.50	14.95	SPT5	SPT5																						
16.00	16.50	DS3	DS3																						

⁽¹⁾ SPT is outside NABL scope



Soil Profile (BH-21)

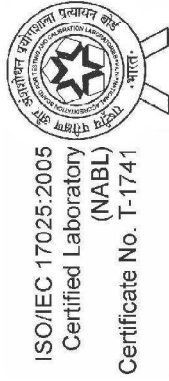
Location : Area-2
UTM Coordinates : 786024 E, 3118574 N
Certificate No. T-1741

Boring Method : Shell & Auger
Casing Depth : 33.5 m
Boring Start : 21-Feb-18
Boring Finish : 22-Feb-18

Termination Depth : 35.45 m
Ground Water Depth : 6.00 m

Depth, m	To	From	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
				Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, φ (degrees)	
17.50	17.95		SPT6	34	27		Dense to very dense grey fine sand (SP-SM)																		
19.00	19.50		DS4				- dense, 17.5 to 29.5 m																		
20.50	20.95		SPT7	37	27																				
22.00	22.50		DS5																						
23.50	23.95		SPT8	45	32																				
25.00	25.50		DS6				- with gravels, 25.0 to 26.5 m																		
26.50	26.95		SPT9	49	33																				
28.00	28.50		DS7																						
29.50	29.95		SPT10	62	39		- very dense, 29.5 to 35.0 m																		
31.00	31.50		DS8																						
32.50	32.95		SPT11	69	42																				
34.00	34.50		DS9																						

⁽¹⁾ SPT is outside NABL scope



Soil Profile (BH-21)

Location : Area-2
UTM Coordinates : 786024 E, 3118574 N

Boring Method : Shell & Auger
Casing Depth : 33.5 m
Boring Start : 21-Feb-18
Boring Finish : 22-Feb-18

Termination Depth : 35.45 m
Ground Water Depth : 6.00 m

Depth, m	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)			Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
		Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)				Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, 'c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
35.00	35.45	74	43		Very dense grey fine sand (SP-SM)	35.45																			
From	To																								

⁽¹⁾ SPT is outside NABL scope



Soil Profile (BH-5)

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Certificate No. T-1741

Location : Area-1

UTM Coordinates : 786000 E, 3118713 N

Termination Depth : 20.45 m

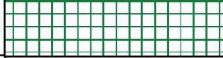
Ground Water Depth : 5.50 m

Boring Method : Shell & Auger

Casing Depth : 18.5 m

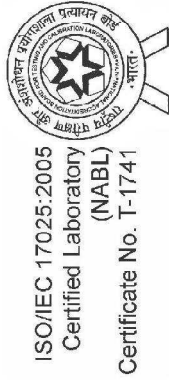
Boring Start : 03-Mar-18

Boring Finish : 03-Mar-18

Depth, m	To From	Sample No.	SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)			
			Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, c (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)				
0.00	0.50	DS1				Very stiff brown sandy silt with gravels, low plastic (CL)	5.50					28.6	16.8	11.8		1.83	1.69	8.5	2.66	UU	1, 2, 3	1.0	12.0				
1.00	1.45	UDS1																									
2.50	2.95	SPT1	16	20																							
4.00	4.45	UDS2																		1.72	1.55	11.6		DS	0.5, 1, 1.5	0.0	32.4
5.50	5.95	SPT2	17	17		Medium dense grey silty fine sand (SM)	17.50	0	61	36	3										DS	0.5, 1, 1.5	0.0	29.2			
7.00	7.45	UDS3																									
8.50	8.95	SPT3	21	20																							
10.00	10.45	UDS4									0	72	27	1									DS	0.5, 1, 1.5	0.0	35.9	
11.50	11.95	SPT4	25	22																							
13.00	13.50	DS2																									
14.50	14.95	SPT5	29	24							0	80	20														
16.00	16.50	DS3																									

⁽¹⁾ SPT is outside NABL scope

** Soil Classification based on field visual



Soil Profile (BH-5)

ISO/IEC 17025:2005
Certified Laboratory
(NABL)
Certificate No. T-1741

Location : Area-1
UTM Coordinates : 786000 E, 3118713 N

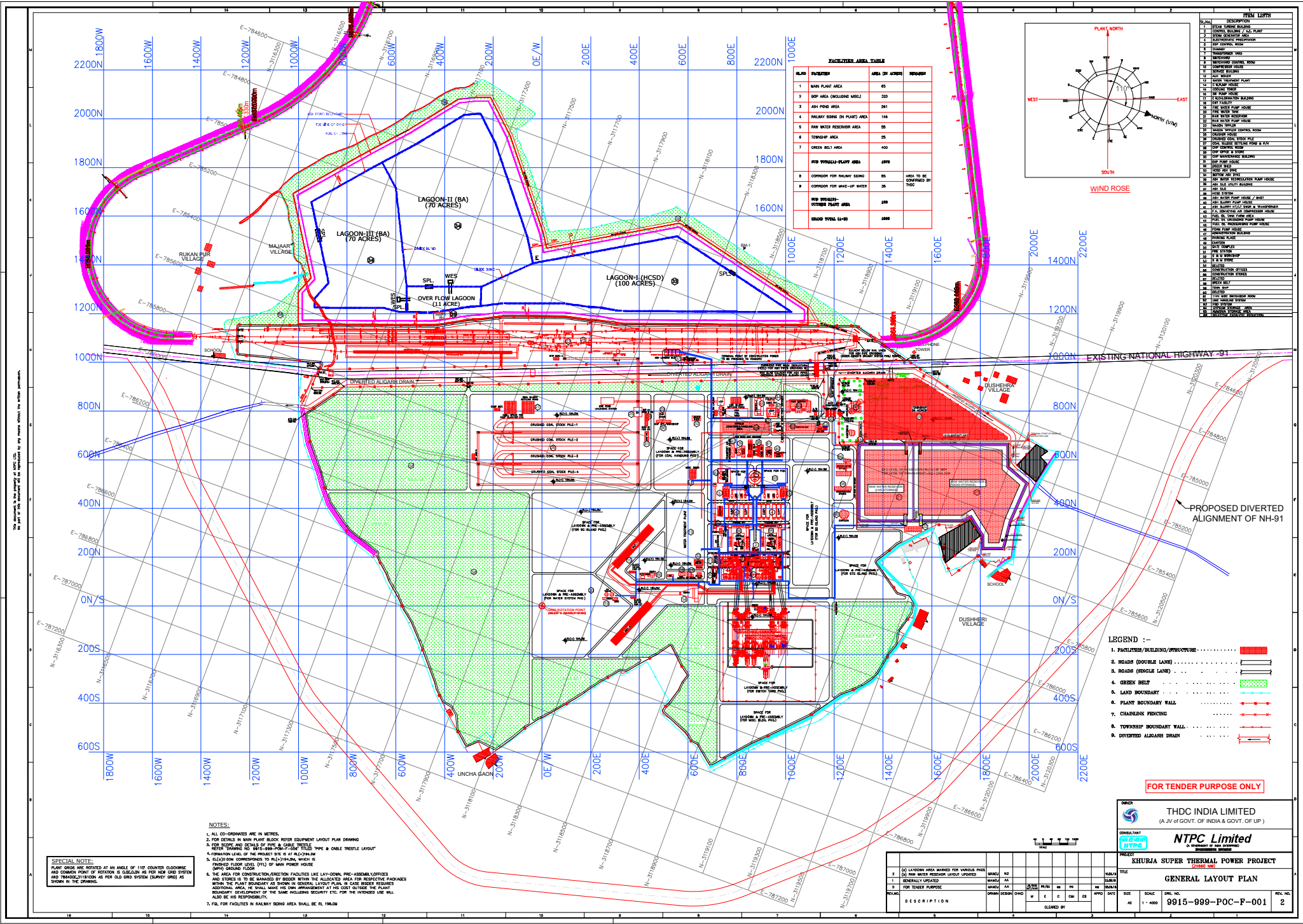
Termination Depth : 20.45 m
Ground Water Depth : 5.50 m

Boring Method : Shell & Auger
Casing Depth : 18.5 m
Boring Start : 03-Mar-18
Boring Finish : 03-Mar-18

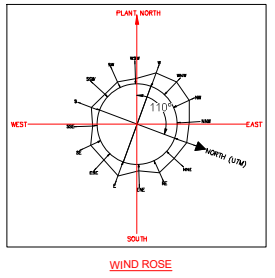
Depth, m	Sample No.		SPT ⁽¹⁾		Symbol	SOIL DESCRIPTION	Depth of Strata, (m)	Grain Size Analysis				Atterberg Limits			Shrinkage Limit, (%)	Density and Moisture			Specific Gravity	Shear Tests				Free Swell Index, (%)
	From	To	Field Value, N _f	Corrected Value, N _c				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Plasticity Index (%)		Bulk Density (gms/cm ³)	Dry Density (gms/cm ³)	Moisture Content (%)		Type of Test	Confining Pressures, (kg/cm ²)	Cohesion Intercept, c' (kg/cm ²)	Angle of Internal Friction, ϕ (degrees)	
17.50	17.95	SPT6	33	26		Dense grey fine sand (SP-SM)	20.45																	
19.00	19.50	DS4																						
20.00	20.45	SPT7	31	24																				

⁽¹⁾ SPT is outside NABL scope

** Soil Classification based on field visual



FACILITIES AREA TABLE			
SL.NO	DESCRIPTION	AREA (IN ACRES)	REMARKS
1	MAIN PLANT AREA	85	
2	ASH POND AREA (INCLUDING MOLD)	220	
3	ASH POND AREA	241	
4	RAINY WATER RESERVOIR AREA	146	
5	RAIN WATER RESERVOIR AREA	25	
6	TURBINE AREA	25	
7	GREEN BELT AREA	400	
8	FOR WINDMILL-PLANT AREA	1076	
9	CONCRETE FOR RAINWATER RESERVOIR	55	AREA TO BE CONSIDERED BY THE
10	CONCRETE FOR WASH-UP WATER	25	
11	FOR WINDMILL-PLANT AREA	1076	
12	GRAND TOTAL (4-10)	2500	



SL.NO	DESCRIPTION
1	MAIN PLANT BUILDING
2	CONCRETE RESERVOIR
3	RAINY WATER RESERVOIR
4	RAINY WATER RESERVOIR
5	RAINY WATER RESERVOIR
6	RAINY WATER RESERVOIR
7	RAINY WATER RESERVOIR
8	RAINY WATER RESERVOIR
9	RAINY WATER RESERVOIR
10	RAINY WATER RESERVOIR
11	RAINY WATER RESERVOIR
12	RAINY WATER RESERVOIR
13	RAINY WATER RESERVOIR
14	RAINY WATER RESERVOIR
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32	RAINY WATER RESERVOIR
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97	RAINY WATER RESERVOIR
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99	RAINY WATER RESERVOIR
100	RAINY WATER RESERVOIR

- NOTES:
1. ALL CO-ORDINATES ARE IN METRES.
 2. FOR DETAILS IN MAIN PLANT BLOCK REFER TO EQUIPMENT LAYOUT PLAN DRAWING.
 3. FOR SHOPS AND DETAILS OF PIPES & CABLE TRAYS REFER TO SHOPS AND DETAILS OF PIPES & CABLE TRAYS LAYOUT.
 4. ELEVATION LEVEL OF THE PROJECT SITE IS AT MSL+100M.
 5. ALL FOUNDATION CORRESPONDING TO MSL+100M, WHICH IS PROVIDED FLOOR LEVEL (FLL) OF MAIN POWER HOUSE.
 6. THE AREA FOR CONSTRUCTION/ERECTOR FACILITIES LIKE LAY-DOWN, PRE-ASSEMBLY, OFFICE AND STORES IS TO BE MARKED BY BORDER WITHIN THE ALLOCATED AREA FOR RESPECTIVE PACKAGES WITHIN THE PLANT BOUNDARY AS SHOWN IN GENERAL LAYOUT PLAN. IN CASE BORDER REQUIRES ADDITIONAL AREA, HE SHALL MARK HIS OWN ARRANGEMENT AT HIS COST OUTSIDE THE PLANT BOUNDARY. DEVELOPMENT OF THE SAME INCLUDING SECURITY ETC. FOR THE INTENDED USE WILL ALSO BE HIS RESPONSIBILITY.
 7. FLL FOR FACILITIES IN RAINWATER RESERVOIR SHALL BE RL 126M.

SPECIAL NOTE:
PLANT GRID ARE ROTATED AT AN ANGLE OF 110° COUNTER CLOCKWISE AND COMMON POINT OF ROTATION IS OBSERVED AS PER NEW GRID SYSTEM AND TRANSLATED IN 110° AS PER OLD GRID SYSTEM (UNROTATED) AS SHOWN IN THE DRAWING.

- LEGEND :-
1. FACILITIES/BUILDING/STRUCTURE
 2. ROADS (DOUBLE LANE)
 3. ROADS (SINGLE LANE)
 4. GREEN BELT
 5. LAND BOUNDARY
 6. PLANT BOUNDARY WALL
 7. CHANNELING PROTECTING
 8. TOWNSHIP BOUNDARY WALL
 9. DIVERTED ALIGNMENT DRAIN

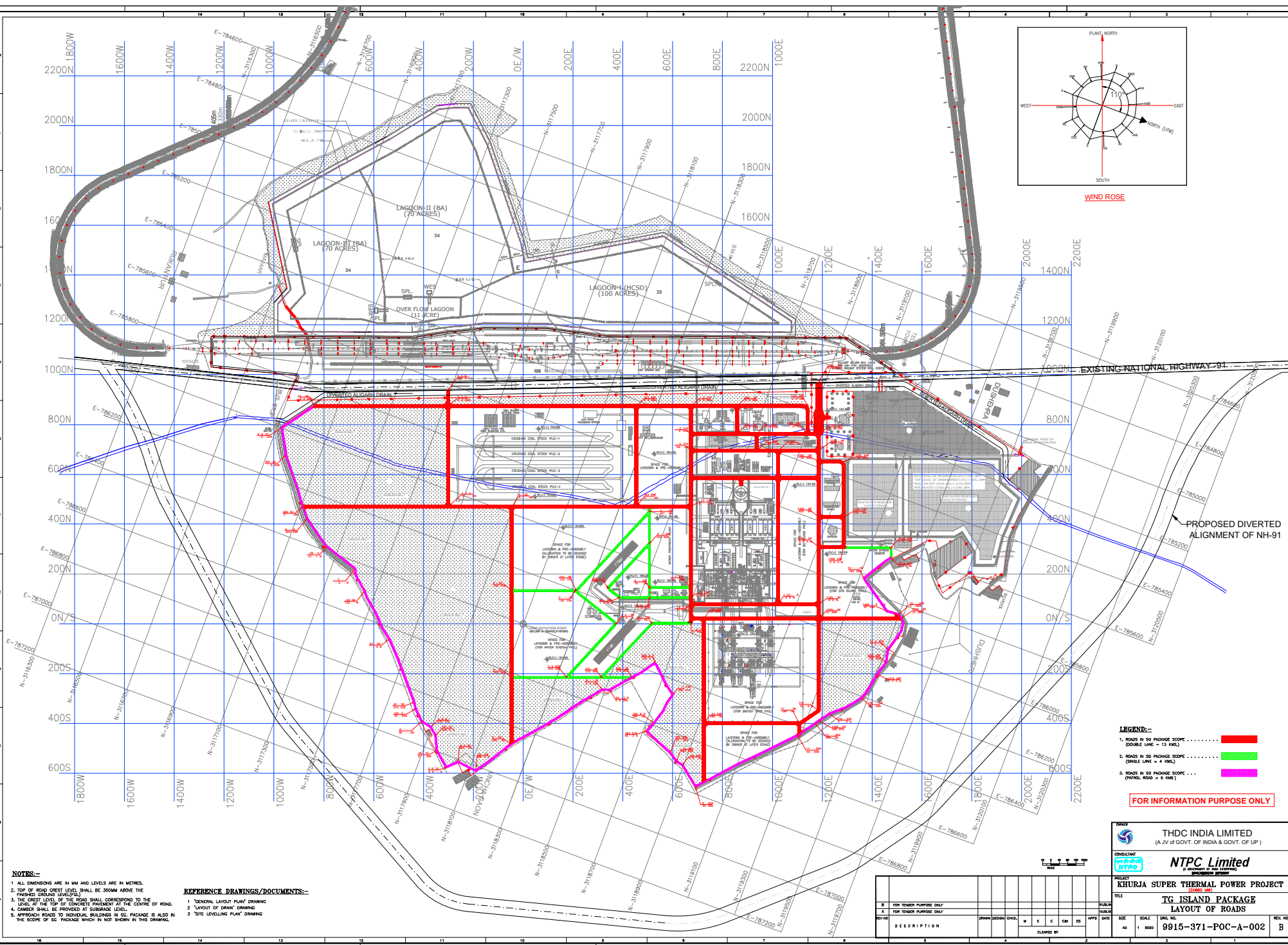
FOR TENDER PURPOSE ONLY

THDC INDIA LIMITED
(A JV OF GOVT. OF INDIA & GOVT. OF UP)

NTPC Limited
(A COMPANY OF NTPC LTD.)

PROJECT INFORMATION									
PROJECT NO.	9915-999-POC-F-001	SCALE	1:4000	DATE	01/01/2020	DESIGNER	DESIGNED BY	APPROVED BY	REVISION
DESCRIPTION	GENERAL LAYOUT PLAN								
REVISION	NO.	DATE	DESCRIPTION	BY	CHECKED BY	APPROVED BY	DATE	REVISION	NO.
1	1	01/01/2020	GENERAL LAYOUT PLAN	DESIGNED BY	CHECKED BY	APPROVED BY	01/01/2020	1	1

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NOTES:-

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES.
2. TOP OF ROAD CREST LEVEL SHALL BE 300MM ABOVE THE PROPOSED FINISH LEVEL OF THE ROAD.
3. THE CREST LEVEL OF THE ROAD SHALL CORRESPOND TO THE LEVEL AT THE TOP OF CONCRETE PAVEMENT AT THE CENTRE OF ROAD.
4. CROWN SHALL BE PROVIDED AT SUBGRADE LEVEL.
5. APPROACH ROADS TO INDIVIDUAL BUILDINGS IN SG PACKAGE IS ALSO IN THE SCOPE OF SG PACKAGE WHICH IS NOT SHOWN IN THIS DRAWING.

REFERENCE DRAWINGS/DOCUMENTS:-

1. 'GENERAL LAYOUT PLAN' DRAWING
2. 'LAYOUT OF DRAIN' DRAWING
3. 'SITE LEVELLING PLAN' DRAWING

LEGEND:-

1. ROADS IN SG PACKAGE SCOPE (DOUBLE LANE = 13 MMS)
2. ROADS IN SG PACKAGE SCOPE (SINGLE LANE = 8 MMS)
3. ROADS IN SG PACKAGE SCOPE ... (PATROL ROAD = 5 MMS)

FOR INFORMATION PURPOSE ONLY

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KHURJA SUPER THERMAL POWER PROJECT
(2000 MW)

TG ISLAND PACKAGE
LAYOUT OF ROADS

DATE: 09/15-371-POC-A-002

NO.	DESCRIPTION	DATE	BY	CHECKED BY	DATE	REVISION	REMARKS
1	FOR TENDER PURPOSE ONLY						
2	FOR TENDER PURPOSE ONLY						
3	FOR TENDER PURPOSE ONLY						
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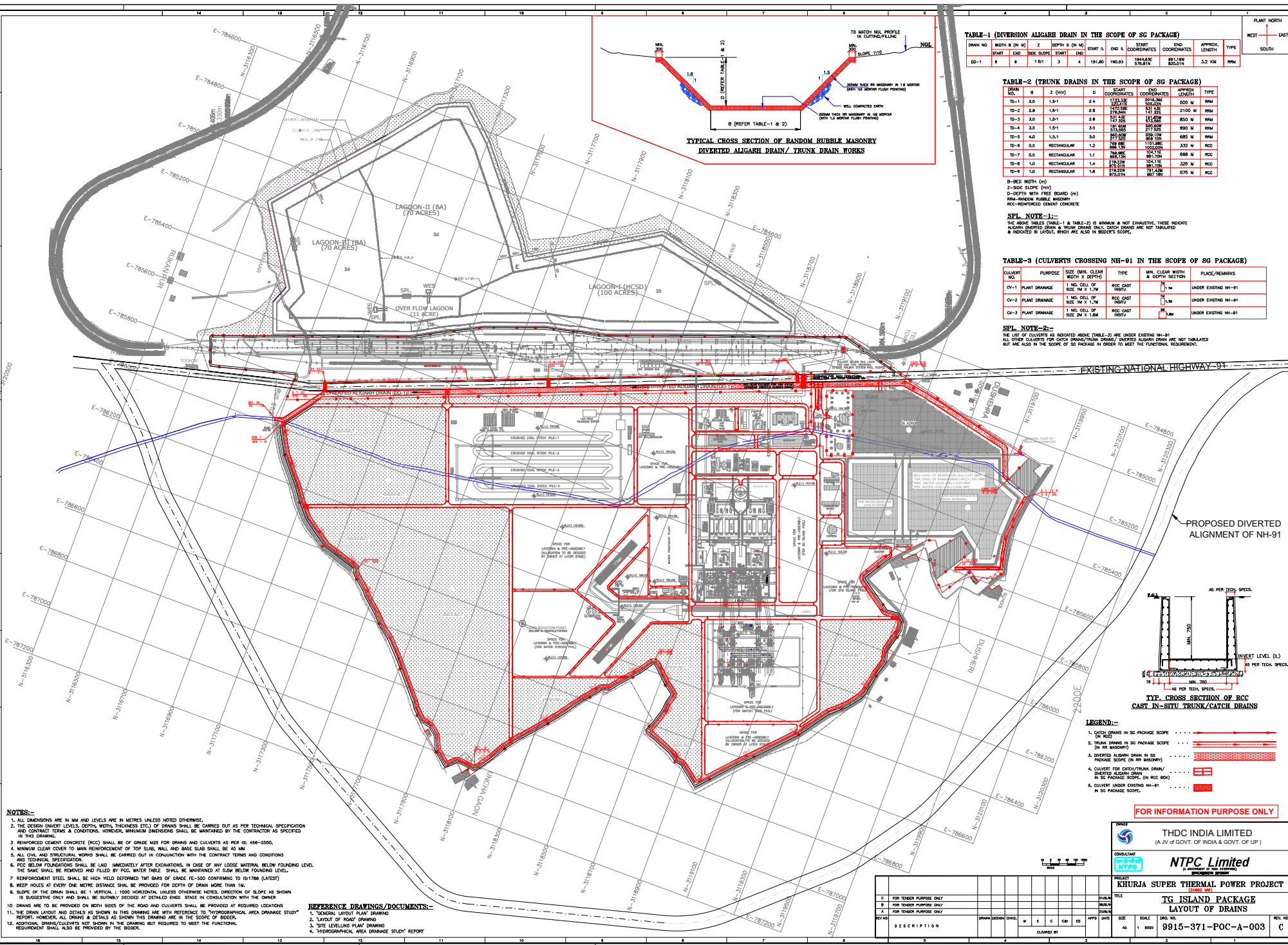


TABLE-1 (DIVERSION ALGARI DRAIN IN THE SCOPE OF SG PACKAGE)									
DRAIN NO.	WIDTH B (IN M)	DEPTH D (IN M)	START STATION	END STATION	START COORDINATES	END COORDINATES	APPROX. LENGTH	TYPE	REMARKS
DD-1	3	1.5	191.00	190.00	784800	784800	3.2	RM	

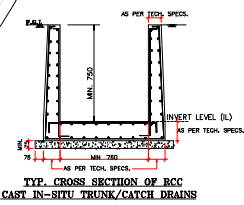
TABLE-2 (TRUNK DRAINS IN THE SCOPE OF SG PACKAGE)									
DRAIN NO.	B (IN M)	D (IN M)	START COORDINATES	END COORDINATES	APPROX. LENGTH	TYPE			
TD-1	2.0	1.5	193.50	193.50	500 M	RM			
TD-2	2.0	1.5	193.50	193.50	2100 M	RM			
TD-3	3.0	1.5	193.50	193.50	850 M	RM			
TD-4	3.0	1.5	193.50	193.50	890 M	RM			
TD-5	4.0	1.5	193.50	193.50	485 M	RM			
TD-6	5.0	1.5	193.50	193.50	532 M	RCC			
TD-7	5.0	1.5	193.50	193.50	686 M	RCC			
TD-8	1.0	1.5	193.50	193.50	325 M	RCC			
TD-9	1.0	1.5	193.50	193.50	575 M	RCC			

B=BED WIDTH (m)
D=DEPTH WITH FREE BOARD (m)
RM=RANDOM RUBBLE MASONRY
RCC=REINFORCED CEMENT CONCRETE

SPL NOTE-1:-
THE ABOVE TABLES (TABLE-1 & TABLE-2) ARE MINIMUM & NOT EXHAUSTIVE. THESE INDICATE ALGARI DRAINS & TRUNK DRAINS ONLY. OTHER DRAINS ARE NOT TABULATED & INDICATED IN LAYOUT, WHICH ARE ALSO IN BIDDY'S SCOPE.

TABLE-3 (CULVERTS CROSSING NH-91 IN THE SCOPE OF SG PACKAGE)					
CULVERT NO.	PURPOSE	SIZE (MM, CLEAR WIDTH X DEPTH)	TYPE	MIN. CLEAR WIDTH & DEPTH SECTION	PLACE/REMARKS
CV-1	PLANT DRAINAGE	1 NO. CELL OF SIZE 1M X 1.7M	RCC GANT INERT	1.7M	UNDER EXISTING NH-91
CV-2	PLANT DRAINAGE	1 NO. CELL OF SIZE 1M X 1.7M	RCC GANT INERT	1.7M	UNDER EXISTING NH-91
CV-3	PLANT DRAINAGE	1 NO. CELL OF SIZE 2M X 1.5M	RCC GANT INERT	1.5M	UNDER EXISTING NH-91

SPL NOTE-2:-
THE LIST OF CULVERTS AS INDICATED ABOVE (TABLE-3) ARE UNDER EXISTING NH-91. ALL OTHER CULVERTS FOR CATCH DRAIN/TRUNK DRAINS/ DRAINED ALGARI DRAIN ARE NOT TABULATED BUT ARE ALSO IN THE SCOPE OF SG PACKAGE IN ORDER TO MEET THE FUNCTIONAL REQUIREMENT.



- LEGEND:-**
- 1. CATCH DRAINS IN SG PACKAGE SCOPE (IN RM)
 - 2. TRUNK DRAINS IN SG PACKAGE SCOPE (IN RM)
 - 3. DIVERTED ALGARI DRAIN IN SG PACKAGE SCOPE (IN RM)
 - 4. CULVERT FOR CATCH/TRUNK DRAIN/ DRAINED ALGARI DRAIN IN SG PACKAGE SCOPE (IN RM)
 - 5. CULVERT UNDER EXISTING NH-91 IN SG PACKAGE SCOPE

FOR INFORMATION PURPOSE ONLY

NTPC Limited
(A JV of GOVT. OF INDIA & GOVT. OF UP)

KHURJA THERMAL POWER PROJECT

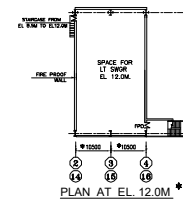
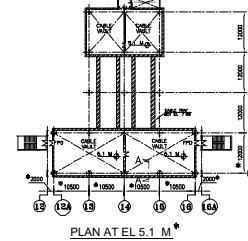
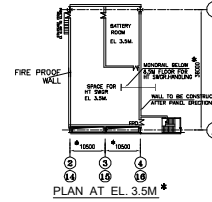
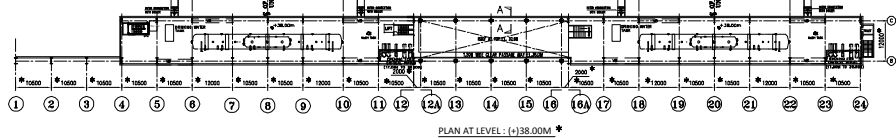
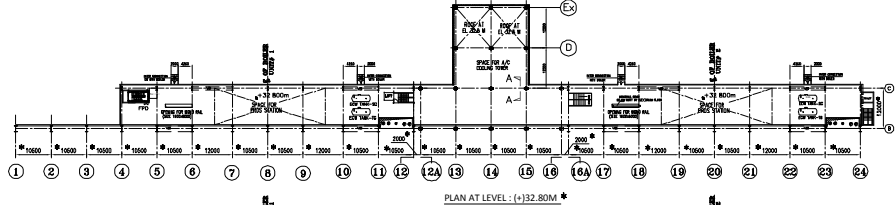
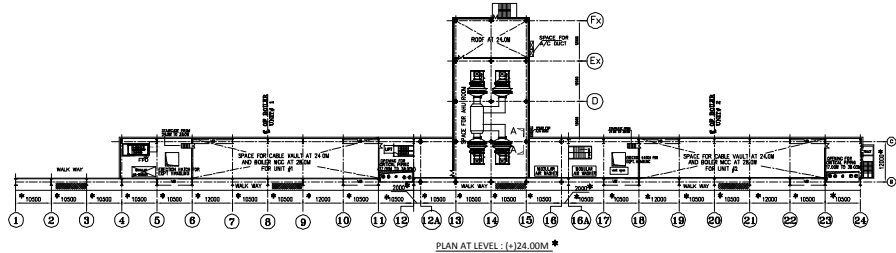
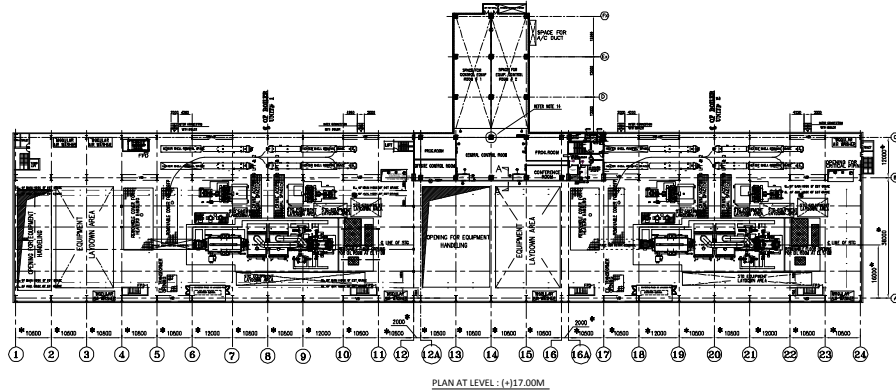
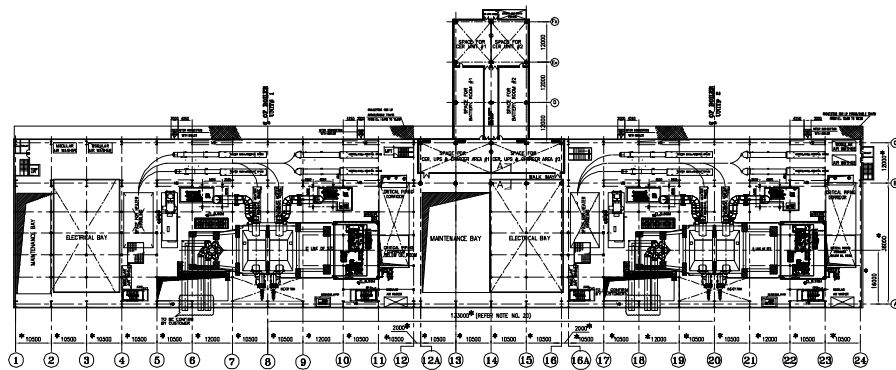
SG ISLAND PACKAGE

LAYOUT OF DRAINS

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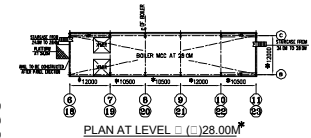
- NOTES:-**
- ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
 - THE DESIGN (INVERT LEVELS, DEPTH, WIDTH, THICKNESS ETC.) OF DRAINS SHALL BE CARRIED OUT AS PER TECHNICAL SPECIFICATION AND CONTRACT TERMS & CONDITIONS. HOWEVER, MINIMUM DIMENSIONS SHALL BE MAINTAINED BY THE CONTRACTOR AS SPECIFIED IN THIS DRAWING.
 - REINFORCED CEMENT CONCRETE (RCC) SHALL BE OF GRADE M25 FOR DRAINS AND CULVERTS AS PER IS: 456-2000.
 - MINIMUM CEMENT COVER TO MAIN REINFORCEMENT OF TOP SLAB, WALL AND BASE SLAB SHALL BE 40 MM.
 - ALL CIVIL AND STRUCTURAL WORKS SHALL BE CARRIED OUT IN CONJUNCTION WITH THE CONTRACT TERMS AND CONDITIONS AND TECHNICAL SPECIFICATION.
 - POC BELOW FOUNDATIONS SHALL BE LAID IMMEDIATELY AFTER EXCAVATIONS, IN CASE OF ANY LOOSE MATERIAL BELOW FOUNDING LEVEL. THE SAME SHALL BE REMOVED AND FILLED BY POC WATER TABLE. SHALL BE MAINTAINED AT 0.5M BELOW FOUNDING LEVEL.
 - REINFORCEMENT STEEL SHALL BE HIGH YIELD DEFORMED TMT BARS OF GRADE FE-500 CONFORMING TO IS:1786 (LATEST).
 - KEEP HOLES AT EVERY ONE METRE DISTANCE SHALL BE PROVIDED FOR DEPTH OF DRAIN MORE THAN 1M.
 - SLOPE OF THE DRAIN SHALL BE 1 VERTICAL : 100 HORIZONTAL UNLESS OTHERWISE NOTED. DIRECTION OF SLOPE AS SHOWN IS SUGGESTIVE ONLY AND SHALL BE SUPPLIED DECIDED AT DETAILED ENGINEERING STAGE IN CONSULTATION WITH THE OWNER.
 - DRAINS ARE TO BE PROVIDED ON BOTH SIDES OF THE ROAD AND CULVERTS SHALL BE PROVIDED AT REQUIRED LOCATIONS.
 - THE DRAIN LAYOUT AND DETAILS AS SHOWN IN THIS DRAWING ARE WITH REFERENCE TO "HYDROGRAPHICAL AREA DRAINAGE STUDY" REPORT. HOWEVER, ALL DRAIN DETAILS AS SHOWN IN THIS DRAWING ARE IN THE SCOPE OF BIDDY.
 - ADDITIONAL DRAINS/CULVERTS NOT SHOWN IN THE DRAWING BUT REQUIRED TO MEET THE FUNCTIONAL REQUIREMENT SHALL ALSO BE PROVIDED BY THE BIDDY.

- REFERENCE DRAWINGS/DOCUMENTS:-**
- "GENERAL LAYOUT PLAN" DRAWING
 - LAYOUT OF ROAD DRAWING
 - "SITE LEVELLING PLAN" DRAWING
 - "HYDROGRAPHICAL AREA DRAINAGE STUDY" REPORT



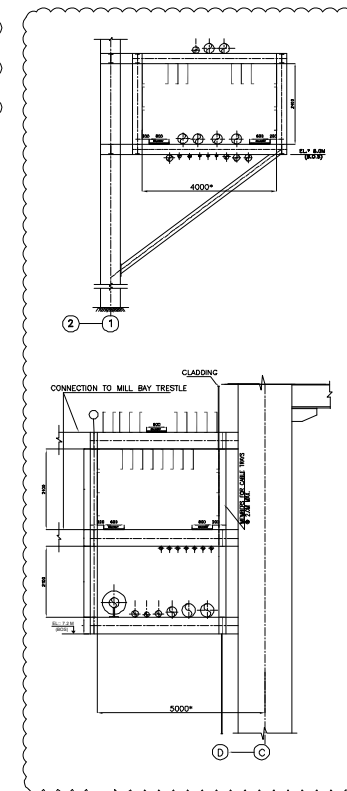
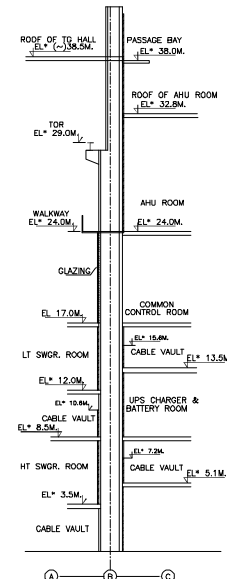
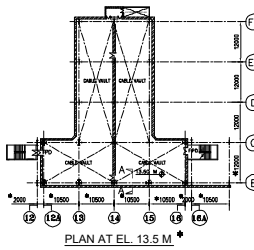
LEGEND

	PIPE HATCH
	VERTICAL BRACING
	FIRE PROOF DOOR
	GRATING
	CHECKERED PLATE
	REMOVABLE HAND RAILING
	DOUBLE DOOR



NOTES

- FALSE CEILING LEVEL.
- FALSE CEILING LEVEL IN UPS, BATTERY CHARGER AND CER AREA SHALL BE EL 11.20 M i.e. 2.70 M ABOVE THE 8.5 M FLOOR LEVEL.
- FALSE CEILING HEIGHT IN CENTRAL CONTROL ROOM SHALL BE 3.65 M. AND FALSE CEILING HEIGHT IN CER AREA SHALL BE 3.00 M.
- BRICKWALL ABOVE FALSE CEILING AT 'D' ROW IN COR AREA TO BE PROVIDED.
- NO WATER/STEAM PIPES INCLUDING RAIN WATER DOWNCOMER SHALL BE ROUTED IN CCR/CER/BATTERY/UPS CHARGER ROOMS. RAIN WATER DOWNCOMER SHALL BE ROUTED WITHIN COLUMN FLANGE ON A-ROW COLUMNS OF ELECTRICAL BAYS & IPD BAY.
- ALL DOORS ON 'D'-ROW PROVIDED AT 8.5M & 17.0M. INTERCONNECTING WITH BOILER ARE OF DOUBLE DOOR TYPE TO AVOID INGRESS OF DUST TO MAIN PLANT BUILDING.
- TO AVOID DUST INGRESS IN THE CCR/CER/UPS ROOM, FOLLOWING SHALL BE ENSURED:
 - DOUBLE DOOR ENTRANCE FOR AHU ROOM/ UPS ROOM/CR/CER.
 - FRESH AIR FAN FOR AHU ROOM SHALL HAVE SUCTION FROM TO HALL SIDE.
 - VENTING DAMPER FOR INERT GAS SYSTEM SHALL BE LOCATED TOWARDS TURBINE HALL SIDE/HEATER SIDE AND NOT ON BOILER SIDE.
- NO VERTICAL BRACING SHALL BE PLACED INSIDE CCR/CER/ELECTRICAL BAY.
- DIRECT SUNLIGHT FALLING ON LVS & OWS SHOULD BE AVOIDED BY PROVIDING TINTED GLASS TOWARDS TO HALL (B) ROW.
- FACILITIES LIKE TOILET (LADIES/GENTS) AND CONFERENCE ROOM SHALL BE PROVIDED NEAR THE CONTROL ROOM AS PER NORMS.
- NO ROOF OVER DEGRADATOR SHALL BE PROVIDED. HANGERS BEAMS & COLUMNS SHALL BE PROVIDED BETWEEN AXES 6-10 & 18-22 OVER DEGRADATOR TO SUPPORT THE PIPING, WITH NO ENCLOSURE ON SIDE. FURTHER, DEGRADATOR SUPPORTS SHALL REST ON BEAMS ONLY.
- LAYOUT OF HP, IP, LP CYLINDERS FOR STEAM TURBINE SHOWN HERE ARE INDICATIVE ONLY.
- THE LOCATION/BAYS INDICATED FOR MODULAR TYPE AIR WASHER LIMITS ARE TENTATIVE AND ARE SUBJECT TO CHANGE DURING DETAILED ENG.
- VOID
- FOR ALL NOTES REFER DRG. NO. 9915-999-POM-F-001.
- COLUMNS IN CONTROL TOWER SHALL BE OF MINIMUM DEPTH AS POSSIBLE.
- WASH BASIN (EMERGENCY SHOWER) SHALL BE PROVIDED IN C&M & ELECTRICAL BATTERY ROOMS IN EACH UNIT.
- LOCATION OF VERTICAL BRACING SHOWN ARE INDICATIVE.
- BAY ALLOCATED FOR CRITICAL PIPING IN TS BUILDING ARE TENTATIVE AND SHALL BE FINALIZED DURING DETAILED ENGINEERING STAGE.
- LOCATION OF BOILER MCC SHOWN ARE INDICATIVE ONLY AND THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.
- DIMENSION THUS (C) MARKED ARE INDICATIVE ONLY.
- UNIT PIPING MAY VARY FROM 113m TO 140m. SAME SHALL BE DECIDED BY OWNER DURING DETAILED ENGINEERING, BASED ON 50 ISLAND & 10 ISLAND PACKAGES VENDOR DATA.

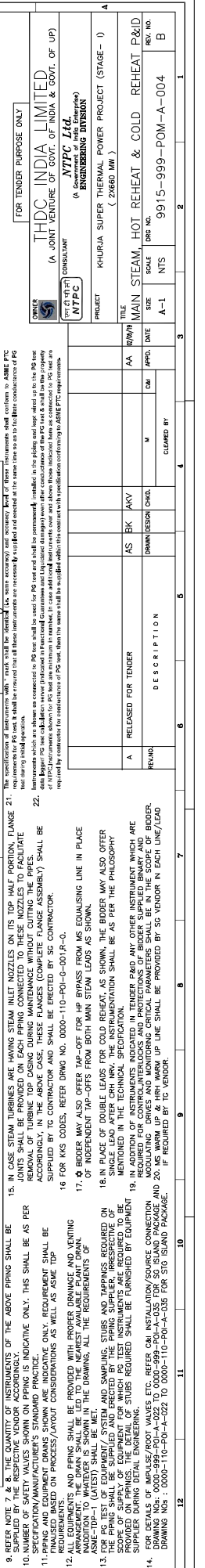


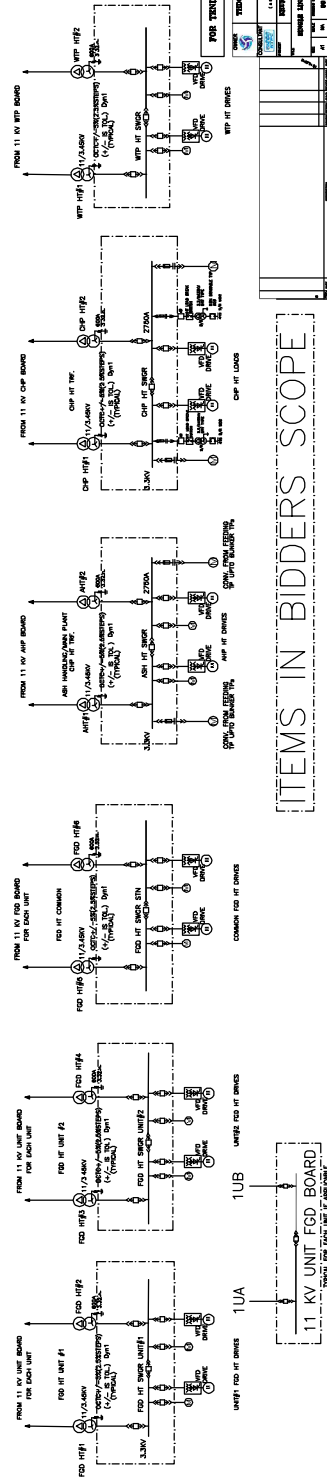
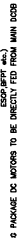
PIPE / CABLE GALLERY TO BE PROVIDED ON C-ROW CANTILEVER AND GABLE END

FOR TENDER PURPOSE ONLY

OWNER	THDC INDIA LIMITED (A JV OF GOVT. OF INDIA & GOVT. OF UP)	
	CONSULTANT	
PROJECT	NTPC Limited (A JV OF NTPC & NTPC LTD.)	
	CONSULTANCY WING	
TITLE	KHURJA SUPER THERMAL POWER PROJECT (2460 MW PRESENT PROPOSAL - 13600 MW FUTURE PROVISION)	
	MAIN PLANT LAYOUT PLAN AT EL. 8.5/17.5M/ 24.0M/28.0M/32.0M/38.0M	
9915-999-POM-F-002		REV. B

REV.	DESCRIPTION	DRAWN/DESIGNED	CHECKED	DATE	BY	DATE	BY	DATE	BY	DATE
A	REVISED IN LINE WITH LAYOUT CHANGES OF SPEC									
B	RELEASED FOR TENDER PURPOSE									



[illegible]

ITEMS IN BIDDERS SCOPE

[illegible]

CLAUSE NO.

QUALITY ASSURANCE

**GENERATORS & AUXILIARIES.****PROCESS CHECK FOR STATIC PARTS GENERATOR / EXCITOR**

TESTS ITEM/ COMPONENTS /PROCESS	Visual & dimension	Chem. Prop.(raw material)	Heat treatment	Mech.Prop.(raw material as applicable)	Impact (raw material)	Hydraulic test	Pneumatic test	RT/UT (10% for butt weld)	MPI/DPT(All welds of trunion & base plate, sample on other)	Relative permeability *	Ferrite content	DIN 43760, IS 2848,7358	DIN 48124
Sheet and Fabrication	Y	Y	Y	Y	Y	Y1	Y1	Y	Y				
-END shield													
-Stator casing	Y	Y	Y	Y	Y	Y1	Y1	Y	Y				
-Bushing boxes	Y	Y	Y	Y	Y	Y1	Y1	Y	Y				
-Terminal plates	Y	Y	Y	Y	Y	Y1	Y1		Y				
-Manhole and covers	Y	Y	Y	Y	Y	Y1	Y1		Y				
-Trunnions	Y	Y	Y	Y	Y			Y	Y				
Core bar	Y	Y		Y									
Press ring	Y	Y		Y					Y				
Core bolt (insulated)	Y	Y		Y				Y	Y				
Gaskets	Y			Y									
Bearing and Hydrogen Seals	Y	Y		Y				Y2					
Terminal Bushing													Y
RTD/ Thermocouple												Y	
Additional checks for										Y			
-Non magnetic Components													
-Non magnetic Components welding											Y		
Y-Test applicable, Y1-For Hydrogen cooled machine, Y2-UT on Babbitt for bearing, * - As per OEM standard practice.													
Note: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. All generators shall be assembled at works and shall be tested to verify/ensure design and workman ship in accordance with IEC-34, VDE 0530, IEEE 115, IEEE 43. The manufacturer shall submit detailed test procedure which clearly specify test set up, instruments to be used, acceptance norms (wherever applicable) recording of different parameter, interval of recording, precautions etc. 3. Cooler, control panel and other auxiliaries (as applicable) to be suitably tested as per tests covered in the specification. 4. Test requirements of primary water system, seal oil system and Hydrogen cooling system shall be as per tests specified for similar items under respective tables covered in this section.													

GENERATORS & AUXILIARIES
PROCESS CHECK FOR CORE GENERATOR/EXCITOR

TESTS ITEM/ COMPONENTS / PROCESS	Specific loss before and after ageing	Magnetization	Anisotropy of losses	Stacking factor	Burr level	chem., elect., viscosity cure time, solid content, dielectric properties	Dimension & surface (uniformity of varnish coat)	Spot weld check
Core lamination	Y	Y	Y	Y			Y	
After punching Insulated core Laminations					Y		Y	
Check for varnish						Y		
Ventilation Stamping								Y
Core assembly							Y	
TESTS ITEM/ COMPONENTS / PROCESS	Process check including Heating & pressure application	Insulation test of insulated core tension bolt & core bar		Functional check of ventilation ducts		Hot spot at rated flux density by infra red camera & ELCID *	Location of temp. detectors	Iron loss at rated flux density
CORE assembly (additional Checks for Generator)	Y	Y		Y		Y	Y	Y

Y-Test applicable

*** In case of any constraint of manufacturer to carry out the test at rated flux , testing at reduced flux as per manufacturer guidelines to be proposed to Owner for review & approval.**

GENERATORS & AUXILIARIES
PROCESS CHECK FOR CORE GENERATOR/EXCITOR

TESTS \ ITEM/ COMPONENTS / PROCESS	Winding copper and connecting bus bars	Insulated conductor	Insulation material	Manufacturing Winding bar & phase bar	Winding laying	Water supply hoses	Winding support ring	Connection between bars	wound stator
Support arrangement					Y	Y			
Type test reports for similar type of bars for heating cycle test, thermal stability test @				Y					
Slot wedge tightness & radial movement									Y
Thermal shock test Baroscopic Examination of brazed water box				Y1					
Inter strand Insulation test				Y				Y2	
Dielectric test at elevated And room temp.		Y							
Vibration fatigue *						Y			
Magnetic permeability of metallic parts						Y			
Reactance of stator winding									Y
Corona protection resistance				Y					
Partial Discharge test				Y#					
Tan delta and delta, tan delta Up to 1.2 un				Y					Y
Check on RTD + location winding					Y				
Helium leak test & PR. test				Y		Y			
Flow test				Y1					Y1
Process check				Y	Y				
X-Ray of Water box				Y1					
Brazing procedure				Y				Y	
Physical prop.			Y				Y		
Electric test			Y	Y	Y				
Dimension/visual		Y	Y	Y	Y	Y	Y		
Dielectric test		Y		Y	Y	Y			
Flexibility of bending temp.		Y							
Insulation adhesion		Y							
Eddy current & pr. Test	Y1								
Metallography prop.	Y								
Resistivity/Resistance	Y								
Chem. prop (sample)	Y		Y			Y	Y		
Mech. prop (sample)	Y		Y			Y			

Y - Test Applicable, Y1- Applicable for hollow conductor, * As per manufacturer established practice, Y2: Not applicable for connection between bars through contact-sleeve (lug), Y#: OEM practice shall be followed, @: Type test reports for similar type of bars for heating cycle test, thermal stability test, and voltage endurance test manufactured from same works from which bars are to be sourced is acceptable if conducted within 5 years of bid opening.

GENERATORS & AUXILIARIES**PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)**

TESTS ITEM/ COMPONENTS / PROCESS	Rep. sample tensile stress	Rep. sample 0.2 limit	Rep. sample elongation	Hardness on Sample	Impact check on sample	Rep. sample Chem. prop.	NDTT, FATT (as applicable)	Process check including heat treatment (as applicable)	Ultrasonic test/RT (at suppliers works and after preliminary machining)	Sulphur Prints Check(Depending on proveness)	Flux carrying capacity / Magnetic prop *	Boroscopic Examination
Rotor forging & slip ring shaft	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rotor end retaining ring, locking ring & Slip ring forgings, diode wheel	Y	Y	Y		Y	Y		Y	Y			
Rotor wedges, damper Wedges.	Y		Y			Y		Y	Y			
Rotor winding copper CC-bolts & D-leads	Y		Y			Y		Y				
Rotor slot boxes/ insulating material						Y						
Coil manufacture												
Rotor winding								Y				
Winding connection studs & assembly												
Complete rotor								Y				
Test on completed rotor at various speed up to rated speed												
Test on completed rotor before & after over speed												
Fan hubs/blades						Y		Y	Y			
GENERATOR assembly												
Diode wheel Assembly												
Permanent magnet					Y						Y	
EXCITER assembly												

Y- Test Applicable

* Not applicable for slip ring shaft of SEE

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

TESTS ITEM/ COMPONENTS /PROCESS	MPI/DP/NDT test	Visual/Dimension/Cleanliness	Adhesion, thickness of Coat on silver plating If applicable	Electrical conductivity and Oxygen content	Mech. test on sample	Electrical test (Σ)	Resistance measurement	Vent hole blockage	Helium leak test for Hydrogen cooled M/C	Inter turn test	Dielectric test
Rotor forging & slip ring shaft	Y	Y									
Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel	Y		Y								
Rotor winding copper, rotor wedges, damper Wedges, CC-bolts & D-leads	Y		Y	Y1		Y					
Rotor slot boxes/insulating material					Y	Y					
Coil manufacture		Y									
Rotor winding	Y	Y				Y		Y		Y	Y
Winding connection studs & assembly	Y				Y				Y		Y
Complete rotor							Y				Y
Test on completed rotor at various speed up to rated speed										Y	Y
Test on completed rotor before & after overspeed		Y					Y			Y	Y
Fan hubs/blades	Y	Y									
GENERATOR assembly		Y									
Diode wheel Assembly		Y									
Permanent magnet		Y			Y						
EXCITOR assembly		Y									

Y-Test Applicable , Y1: Oxygen content applicable for Rotor winding copper & D Lead,
 Σ NOTE- Dielectric test & conductivity test etc. as applicable

GENERATORS & AUXILIARIES**PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)**

TESTS ITEM/ COMPONENTS /PROCESS	Insulation Resistance	PI	Radial run out/alignment	Impedance measurement/ RSO (repetitive surge oscillograph)	Dynamic balancing ISO 5406, 2372, 1940	Over speed test (120%) for 2 minute	Axial run out	Metallography examination *	Torque on joint bolts	Fitting and locking of Balancing weights	Brazer and brazing procedure
Rotor forging & slip ring shaft								Y			
Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel											
CC-bolts									Y		
Rotor slot boxes/ insulating material											
Coil manufacture											Y
Rotor winding											Y
Winding connection studs & assembly	Y										
Complete rotor	Y		Y	Y	Y	Y			Y		
Test on completed rotor at various speed up to rated speed				Y							
Test on completed rotor before & after overspeed	Y		Y	Y							
Fan hubs/blades										Y	
GENERATOR assembly	Y	Y	Y				Y		Y	Y	Y
Diode wheel Assembly			Y				Y		Y	Y	
Permanent magnet											
EXCITOR assembly			Y						Y	Y	

Y-Test applicable * - As per OEM standard practice.

GENERATORS & AUXILIARIES**ADDITIONAL CHECK FOR EXCITOR**

ITEM/ COMPONENTS /PROCESS	TESTS	Routine Test as per applicable std	As per IEC-76 / Applicable std	Pole parallelism & polarity	Mech. chem. & Magnetic prop. (as applicable)	Functional check	Insulation resistance	IEEE/ANSI-C37.18 Or IEC 60947-2	As per applicable standards	As per specification	Dimensional and visual
Fuse diode & filter Circuit		Y									Y
Aux. Transformer (if applicable)			Y								
Carbon brush holder & housing					Y	Y				Y	Y
Cable										Y	
PMG & Exciter stator				Y	Y		Y				
Bandaging wire					Y						
Field discharge resistor						Y					
Bearing, exciter armature field, axis coil , RTD							Y				
Excitation Transformer			Y								
Thyristors										Y	
Field breaker						Y		Y			
Bus duct AC/DC									Y		
Voltage Regulator										Y	
Carbon brush					Y	Y				Y	Y

Y - Test applicable

GENERATOR AND AUXILIARIES**FINAL ACCEPTANCE TEST GENERATOR/EXCITOR**

ITEM/ COMPONENTS /PROCESS	TESTS	Works run test on generator to be conducted on first unit of each rating per contract to establish the performance characteristics / designated attributes	On total winding/phase at interval of 0.2 U _n for generator	Condition after dismantling (after works run test)	Works test on brush less exciter	PMG works test	Full load for PMG & converter assembly	Converter assembly for SEE	Static excitation system
Partial Discharge		Y							
Visual and dimension		Y							
Vibration Measurement		Y							
Winding Overhang				Y					
Seal Ring. Liners				Y					
Bearing oil catcher				Y					
Rotor journal				Y					
Tan delta, delta tan delta		Y	Y						
Capacitance measurement		Y	Y						
RTD, BTD Check		Y							
HV test (except electronic circuit)		Y			Y	Y		Y	Y
Shaft voltage		Y							
Phase seq. voltage		Y				Y			
Polarization index		Y							
Insulation resistance		Y			Y	Y		Y	Y
Efficiency By separation of Losses		Y							
Steady state reactance's		Y							
Record Aux. parameters		Y							
SCC		Y							
OCC		Y			Y	Y			
Voltage regulation						Y			
Function check								Y	Y
Heat run test		Y			Y	Y	Y		
Rotor impedance at various speeds in steps of 200 rpm		Y							
Resistance measurement		Y			Y	Y			
Gas tightness for Hydrogen cooled M/C		Y							

Y – Test Applicable

GENERATORS & AUXILIARIES

FINAL ACCEPTANCE TEST GENERATOR/EXCITOR

ITEM/ COMPONENTS /PROCESS	TESTS									
	Seal rings, liners	Winding Overhang	Vibration measurement	No load	Load characteristics	Characteristics of search coil, quad, axis	Ripple content	As per specification	Visual & dimension	Partial discharge
Works test on brush less exciter			Y	Y	Y	Y			Y	
PMG works test				Y	Y					
Static excitation system							Y	Y	Y	

Y - Test Applicable

PROPOSED COAL CHARACTERISTICS FOR KHURJA(2X660 MW)

APPENDIX-II

S.No.	Characteristics		Range of 95 % coal supplies			Range of 5 %	
	(as received basis)					coal supplies	
1.0	PROXIMATE ANALYSIS		Design	Worst	Best		
1.1	Total Moisture (%)		12	14	11.0	11-15	
1.2	Ash (%)		32	35	28	28-40	
1.3	Volatile Matter (%)		24	23	25	22-26	
1.4	Fixed Carbon (%)		32	28	36.0	28-36	
1.5	Total (%)		100	100	100		
2.0	ULTIMATE ANALYSIS						
2.1	Carbon (%)		42.3	37.81	46.83	35.21-45.4	
2.2	Hydrogen (%)		3.2	2.8	3.3	2.8-3.9	
2.3	Sulphur (%)		0.4	0.6	0.3	0.3-0.6	
2.4	Nitrogen(%)		1	0.58	1.3	0.58-1.4	
2.5	Oxygen(%) (By difference)		8.73	8.72	8.77	8.5-9.0	
2.6	Carbonates (%)		0.27	0.38	0.45	0.27-0.45	
2.7	Phosphorous(%)		0.06	0.06	0.04	0.04-0.06	
2.8	Total Moisture (%)		12	14	11.0	11.0-15.0	
0.04	Ash (%)		32	35	28	28-40.0	
3	Chloride		0.04	0.05	0.01	0.01-0.04	
3.1	Fluoride						
2.13	Trace Elements (PPM)						
2.14	Arsenic		0.025	0.03	0.02	0.015-0.035	
2.15	Lead		30	32	10	35-10	
2.16	Mercury		0.06	0.1	0.02	0.01-0.15	
2.17	Selenium		0.03	0.1	0.01	0.2-0.01	
2.18	Total		100	100	100		
2.10	GCV (Kcal/Kg)		4250	3700	4800	3600-4800	
2.11	Hard Grove Index		60	52	65	50-65	
2.12	YGP (mg/kg)		70	75	70	85-70	
3.0	ASH ANALYSIS						
3.1	Silica (%)		58.2	59.54	58.00	58.1-63	
3.2	Alumina(%)		28	26.3	27.20	22.2-26.1	
3.3	Iron Oxide (%)		6.1	6.4	7.60	8.3-11.5	
3.4	Titania		1.85	1.72	1.80	0.82-1.2	
3.5	Phosphoric Anhydride (%)		1.91	1.57	0.48	0.48-1.91	
3.6	Lime (%)		1.7	3.2	3.30	1.78-3.5	
3.7	Magnesia (%)		0.7	0.6	0.50	0.5-0.9	
3.8	Sulphuric Anhydride (%)		0.29	0.25	0.40	0.12-0.43	
3.9	Sodium Oxide (%)		0.3	0.1	0.30	0.1-0.32	
3.10	Potassium oxide		0.95	0.32	0.42	0.1-0.43	
	Total		100	100.00	100.00		
4.0	ASH FUSION RANGE						
	REDUCING ATMOSPHERE						
4.1	Initial Deformation Temp.(oC)		1200	1100	1150	1100	1200
4.2	Hemispherical Temp. (oC)		1400	1300	1350	1200	1400

4.3	Fusion Temperature (oC)	1400	1400	1350	1400	1450
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