

Clarification No. 04 to Bidding Document (Commercial Portion)

S/N	Section/Part/ Chapter/Volume	Clause No.	Page No.	Bidding Document Clause	Statement of Bidders' Queries & Clarifications	Employer's Reply
					which event the Contractor shall obtain from ~~such~~ major Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16. <u>Confidential Information shall be marked as "Confidential". Oral information shall be reduced to writing within 10 days of such disclosure.</u>	
40.	Section-IV, GCC	16.3	19/57	The obligation of a party under GCC Sub Clauses 16.1 and 16.2 above, however, shall not apply to that information which (a) now or hereafter enters the public domain through no fault of that party (b) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto (c) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.	We request Employer to add following at the end of clause: <u>(d) is required to be disclosed in accordance with a judicial or arbitral or governmental order or decree.</u>	Provisions of Bidding documents shall prevail.
41.	Section-IV, GCC	16.5	19/57	The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.	We request the Employer to modify the clause as follows:	Provisions of Bidding documents shall prevail.

Package: Turbine Generator And Associated Packages

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

Doc. No.: THDC/RKSH/CC-9915-371-CLRF.04

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					The provisions of this GCC Clause 16 shall survive for <u>one-year post</u> termination, for whatever reason, of the Contract.	
42.	Section-IV, GCC	17.2.3	20/57	The Contractor's Representative may, subject to the approval of the Employer (which shall not be unreasonably withheld), at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation.....	We request Employer to modify the clause as follows: The Contractor's Representative may, <u>with a written notice to</u> ~~subject to the approval of the Employer (which shall not be unreasonably withheld)~~ , at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation.....	Provisions of Bidding documents shall prevail.
43.	Section-IV, GCC	18.4	22/57	Progress of Performance If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub Clause 18.2 (Program of Performance), or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the	We request Employer to add following sentence at the end of this clause: <u>Moreover, in case, Contractor's actual progress falls behind the program for reasons attributable to the Employer, then Cost compensation shall also be provided to the Contractor.</u>	Provisions of Bidding documents shall prevail.

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				steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub Clause 8.2 (Time for Commencement and Completion), any extension thereof entitled under GCC Sub Clause 40.1 (Extension of Time for Completion), or any extended period as may otherwise be agreed upon between the Employer and the Contractor.		
44.	Section-IV, GCC	19.1	22/57	Subcontracting	The bidder will submit a list of sub-vendors/ sub-contractors of major equipments in the Bid. The bidder shall select from amongst the list of sub-vendors/ sub-contractors. In case the Employer wishes to delete name of any sub-vendor/ sub-contractor from the proposed list, the same shall be discussed and agreed upon with the bidder prior to submission of Price Bid. In case the bidder wishes to propose a new sub-vendor/sub-contractor/fabricator, Employer shall without delay grant approval or otherwise to the same so as not to impede the progress of work.	Provisions of Bidding documents shall prevail.

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45.	Section-IV, GCC	20.3.2	24/57	Within twenty one (21) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub Clause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes.	We request the Employer to modify the clause as follows: Within ~~twenty one (21)~~ fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub Clause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes. <u>If the Project Manager fails to approve or disapprove any document within fourteen (14) days of receipt of such document, then, for any further delay in such approval or disapproval from Project Manager, the Contractor shall be eligible for Extension of Time for Completion as per GCC 40.1 (e).</u>	Provisions of Bidding documents shall prevail.
46.	Section-IV, GCC	20.3.4	24/57	If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub Clause 20.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), and upon resubmission with the required modifications the document shall be	We understand that the Contractor shall be at liberty to proceed with manufacturing / construction as per the commented drawings / documents. The resubmission for approval will be only for the purpose of formalizing the same. Kindly confirm.	Provisions of Bidding documents shall prevail.

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				deemed to have been approved. The procedure for submission of the documents by the Contractor and their approval by the Project Manager shall be discussed and finalised with the Contractor.		
47.	Section-IV, GCC	22.1.1	26/57	 If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer.	We request Employer to modify the clause as follows: If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer. <u>Moreover, If the work of Contractor is delayed due to above reasons attributable to the Employer then suitable time extension shall also be granted to Contractor.</u>	Provisions of Bidding documents shall prevail.
48.	Section-IV, GCC	22.2.1	27/57	All Contractor's Equipments brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent	We request the Employer to modify the clause as follows: All Contractor's Equipments brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The	Provisions of Bidding documents shall prevail.

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				that such Contractor's Equipments are no longer required for the execution of the Contract.	Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipments are no longer required for the execution of the Contract. <u>However, on the request of Contractor the Project Manager shall grant his consent if both parties mutually agree that the removal of such equipment shall not hinder the progress of work and the Contractor takes responsibility that he will make available such equipment as and when required in the future.</u>	
49.	Section-IV, GCC	22.4	28/57	Opportunities for Other Contractors	We request Employer to add new sub-clause 22.4.5 at the end of clause as follows: <u>22.4.5 Pursuant to GCC sub-clause 22.4.1, if the performance of the Contract is affected, the Contractor shall be entitled to extension in Time for Completion pursuant to GCC Clause 40 and suitable cost compensation.</u>	Provisions of Bidding documents shall prevail.
50.	Section-IV, GCC	22.4.4	28/57	The Contractor shall notify the Project Manager promptly of any defects in the other Contractors' work that come to its notice, and that could affect the Contractor's work. The Project Manager shall determine the corrective measures, if any, required to rectify the situation after inspection of the Facilities. Decisions made by	We request Employer to modify the clause as follows: The Contractor shall notify the Project Manager promptly of any defects in the other Contractors' work that come to its notice, and that could affect <u>or has affected</u> the Contractor's work. The Project Manager shall determine the corrective	Provisions of Bidding documents shall prevail.

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				the Project Manager shall be binding on the Contractor.	measures, if any, required to rectify the situation after inspection of the Facilities- ~~Decisions made by the Project Manager shall be binding on~~ <u>in consultation with the</u> Contractor.	
51.	Section-IV, GCC	23.3	29/57	Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager (or their designated representatives) to attend the test and/or inspection.	We understand that Inspection schedule and Test timeline shall be finalized after the award of contract. In case the Employer/ third party agency (TPI) is not able to participate or witness the test within the mentioned test timeline, the inspection shall be deemed to be waived off. Kindly confirm.	Provisions of Bidding documents shall prevail.
52.	Section-IV, GCC	24	32/57	Completion of the Facilities- NEW CLAUSE	We request the Employer to insert a new sub clause as given below: <u>In case there is a delay in achieving successful Completion of the Facilities, due to reasons not attributable to the Contractor, the Employer shall release the associated payment stipulated at Sl. Nos. A1(VI), B1(VI), E(IV), F(V) & G(VI) under Appendix-1 to From of Contract Agreement (Terms and Procedures of Payment) against submission of equivalent amount of Bank Guarantee by the Contractor. Such Bank Guarantee</u>	Provisions of Bidding documents shall prevail.

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					<u>shall have validity of one (1) year. Beyond this period, the Contractor shall be deemed to have fulfilled its obligations with respect to Completion of Facilities.</u>	
53.	Section-IV, GCC	25.3.3	33/57	The Project Manager shall, after consultation with the Employer, and within forty five (45) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.	We understand that the operational acceptance certificate shall be issued unit wise. Kindly confirm.	Bidder may refer clause 25.4 (Partial Acceptance) of Section IV (GCC) and Clause 2.0 (Definitions) of SCC in this regard.
54.	Section-IV, GCC	25.5	34/57	NEW CLAUSE	In case the components/plant systems or any other inputs falling in Employer's scope of responsibility affect the project schedule, the Employer will provide suitable extension of Time for Completion and increase the Contract Price based on mutual discussion with the Contractor. However, in case the unit is ready for commissioning and the Employer is unable to permit the Contractor to proceed owing to statutory, environmental, lack of start up steam, fuel, utilities or any other reason beyond Contractor's control, the unit shall be deemed to have been taken over on the scheduled date of commissioning. In such event, all liabilities of Contractor in respect of Contract shall be deemed to have been discharged. Defect Liability Period for the unit shall commence on such deemed acceptance date. All Bank Guarantees and payments due on achieving such milestones shall be released immediately.	Provisions of Bidding documents shall prevail.

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55.	Section-IV, GCC	26.2	34/57	If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion), the Contractor shall pay to the Employer liquidated damages in the amount computed at the rates specified in the SCC. The aggregate amount of such liquidated damages shall in no event exceed the amount specified as "Maximum" in the SCC. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub Clause 42.2.2.	Please note that should the Employer exercise the option of levying liquidated damages (LD), this shall be the sole remedy available to the Employer. Also in case of delay, the Contractor shall be given opportunity to represent his case for extension of Time for Completion without levy of LD.	Provisions of Bidding documents shall prevail.
56.	Section-IV, GCC	26.3	35/57	No bonus will be given for earlier completion of the facilities or part there of.	In order to motivate the Contractor to achieve early Completion of Facilities ahead of schedule, we request Employer to consider providing financial incentives to the Contractor for achieving early Completion of Facilities.	Provisions of Bidding documents shall prevail.
57.	Section-IV, GCC	27.2	35/57	 If during the Defects Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipments supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise	We request the Employer to modify the clause as follows: If during the Defects Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipments supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the	Provisions of Bidding documents shall prevail.

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				make good (as the Contractor shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:.....	defects, and at its cost, repair, replace or otherwise make good (as the Contractor shall, at its discretion, determine) such defect ~~as well as any damage to the Facilities caused by such defect.~~ <u>Notwithstanding anything stated herein, The the</u> Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:.....	
58.	Section-IV, GCC	27.2	35/57	Defects Liability	The Contractor shall not be responsible for: a) Repair/remedy or otherwise making good of any equipment/facility, which is not within his scope of work under the Contract due to defects arising during Defect Liability Period. b) Compensation for any losses of any kind to any third party other than repair/remedy or otherwise making good the equipment/parts, within his scope under the Contract and reported by the Employer in his warranty claims except for the provision in GCC Clause No. 33 and 34.	Provisions of Bidding documents shall prevail.

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59.	Section-IV, GCC	27.3	33/57	(c) any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Sub Clause 27.7.	We request Employer to modify the clause as follows: (c) any other materials supplied or any other work executed by or on behalf of the Employer, ~~except for the work executed by the Employer under GCC Sub Clause 27.7.~~	Provisions of Bidding documents shall prevail.
60.	Section-IV, GCC	27.5	36/57	 The Contractor may, with the consent of the Employer, remove from the Site any Plant and Equipment or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.	We request the Employer to modify the clause as follows: The Contractor may, with the consent of the Employer, remove from the Site any Plant and Equipment or any part of the Facilities that are defective if the nature of the defect, ~~and/or any damage to the Facilities caused by the defect,~~ is such that repairs cannot be expeditiously carried out at the Site.	Provisions of Bidding documents shall prevail.
61.	Section-IV, GCC	27.7	36/57	If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due to	We request the Employer to modify the clause as follows: If the Contractor fails to commence the work necessary to remedy such defect ~~or any damage to the Facilities caused by such defect~~ within a reasonable time (which shall in no event be considered to be less than ~~fifteen (15)~~ <u>thirty (30)</u> days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or	Provisions of Bidding documents shall prevail.

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				the Contractor or claimed under the Performance Security.	may be deducted by the Employer from any monies due to the Contractor or claimed under the Performance Security.	
62.	Section-IV, GCC	27.8	36/57	If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defects Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons. Upon correction of the defects in the Facilities or any part thereof by repair/replacement, such repair/replacement shall have the Defects Liability Period extended by a period of twelve (12) month from the time such replacement/repair of the Facilities or any part thereof.	We request Employer to modify the clause as follows: If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defects Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons. Upon correction of the defects in the Facilities or any part thereof by repair/replacement, such repair/replacement shall have the Defects Liability Period extended by a period of twelve (12) month from the time such replacement/repair of the Facilities or any part thereof. <u>Notwithstanding the above, in no event shall the Defect Liability on any part or component exceed twenty-four (24) months from the date of Completion of Facilities or Operational Acceptance of the Facilities, whichever occurs first ('Sunset Date').</u> <u>Notwithstanding the Sunset Date, where a recurring defect of any particular part or</u>	Provisions of Bidding documents shall prevail.

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					<u>component results in the failure of such part or component more than twice within the appropriate sun-set date, such part or component shall be replaced or repaired by the Contractor until such time that such part or component has operated without failure for a period of twelve (12) months from the date of installation of such replaced/repared part.</u>	
63.	Section-IV, GCC	27.8.1	36/57	At the end of the Defects Liability Period, the contractor liability ceases except for latent defects. The contractor's liability for latent defects warranty shall be limited to a period of five (5) years from the end of Defects Liability Period.	We request the Employer to modify the clause as follows: At the end of the Defects Liability Period, the contractor liability ceases except for latent defects. The contractor's liability for latent defects warranty shall be limited to a period of five (5) years from the ~~end of Defects Liability Period~~ Completion of the Facilities.	Provisions of Bidding documents shall prevail.
64.	Section-IV, GCC	28.2	37/57	 If the specified Functional Guarantees are not established even during the repeat of the Guarantee Tests, the Employer may at its option, either (a) Reject the Equipments and recover the payments already made, or (b) Terminate the Contract pursuant to GCC Sub Clause 42.2.2 and recover the payments already made, or	We request the Employer to modify the clause as follows: If the specified Functional Guarantees are not established even during the repeat of the Guarantee Tests, the Employer may exercise at its options, <u>as specified in Clause No. 1.00.01 (k) of Part-A, Section-VI (Technical Specifications)</u> either ~~(a) Reject the Equipments and recover the payments already made, or~~	Provisions of Bidding documents shall prevail.

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				(c) Accept the equipment after levy of liquidated damages in accordance with the provisions specified in Appendix 8 (Functional Guarantees) to the Form of Contract Agreement.	~~(b) Terminate the Contract pursuant to GCC Sub Clause 42.2.2 and recover the payments already made, or~~ ~~(c) Accept the equipment after levy of liquidated damages in accordance with the provisions specified in Appendix 8 (Functional Guarantees) to the Form of Contract Agreement.~~	
65.	Section-IV, GCC	29.1	37/57	The Contractor shall, subject to the Employer's compliance with GCC Sub Clause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.	We request the Employer to modify the clause as follows: The Contractor shall, subject to the Employer's compliance with GCC Sub Clause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all direct and proven suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.	Provisions of Bidding documents shall prevail.

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66.	Section-IV, GCC	31.2	39/57	Ownership of the Plant and Equipment (including spare parts) quoted in Schedule 2 shall be transferred to the Employer when the Plant and Equipment (including spares) are loaded on to the mode of transport to be used to convey the Plant and Equipment (including spares) from the works to the site and upon endorsement of the despatch documents in favour of the Employer.	This ownership clause imputes Sale in Transit. In GST, there is no such concept of Sale in Transit and the Contractor/vendor in its discretion can prefer either to make local sales or in transit sales in terms of Section 10(1)(b) of the IGST Act. Hence, transit sale condition should be optional which the Contractor / vendor shall choose as per his feasibility.	Provisions of Bidding documents shall prevail.
67.	Section-IV, GCC	31.2	39/57	Ownership of the Plant and Equipment (including spare parts) quoted in Schedule 2 shall be transferred to the Employer when the Plant and Equipment (including spares) are loaded on to the mode of transport to be used to convey the Plant and Equipment (including spares) from the works to the site and upon endorsement of the despatch documents in favour of the Employer.	We request Employer to modify the clause as follows: Ownership of the Plant and Equipment (including spare parts) quoted in Schedule 2 shall be transferred to the Employer when the Plant and Equipment (including spares) are loaded on to the mode of transport to be used to convey the Plant and Equipment (including spares) from the works to the site and upon endorsement of the despatch documents in favour of the Employer. <u>Once the Plant and Equipment are loaded on the mode of transportation used to convey the Plant and Equipment, risks in such Plant and Equipment shall stand transferred to the Employer.</u>	Provisions of Bidding documents shall prevail.

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68.	Section-IV, GCC	31.5	39/57	Notwithstanding the transfer of ownership of the Plant and Equipment, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant and Equipment are incorporated.	We request Employer to delete this clause.	Provisions of Bidding documents shall prevail.
69.	Section-IV, GCC	31.6	39/57	In case of two/three Contracts entered into between the Employer and the Contractor as per GCC Sub Clause 3.6 or where the Employer hands over his equipments to the Contractor for executing the Contract, then the Contractor shall at the time of taking delivery of the Equipment through Bill of Lading or other despatch documents furnish Trust Receipt for Plant, Equipment and Materials and also execute an Indemnity Bond in favour of the Employer.....	Since the Bidder is responsible for all the three (3) Contracts, the Trust receipt and Indemnity bond should not be required. Therefore, the provision regarding furnishing of Trust receipt and Indemnity bond may please be deleted.	Provisions of Bidding documents shall prevail.
70.	Section-IV, GCC	32.2	39/57	where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub Clause 42.1 (Termination for Employer's Convenience) hereof, except that the Contractor shall have no entitlement to profit under	We understand that the Contractor shall be entitled to all the costs and claims as mentioned under paragraph (e) of GCC Sub Clause 42.1.3 in respect of any unexecuted Facilities as at the date of termination. Kindly confirm.	Provisions of Bidding documents are clear and shall prevail.

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				paragraph (e) of GCC Sub Clause 42.1.3 in respect of any unexecuted Facilities as at the date of termination.		
71.	Section-IV, GCC	35.1	44/57	If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions (other than climatic conditions) or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination.....	We request Employer to modify the clause as follows: If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions ~~(other than climatic conditions)~~ or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination.....	Provisions of Bidding documents are clear and shall prevail.
72.	Section-IV, GCC	37.1	45/57	“Force Majeure” shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected.	We request Employer to modify the clause as follows: “Force Majeure” shall mean any event beyond the reasonable control of the Employer or of the Contractor <u>and its Subcontractors / Sub vendors</u> , as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected.	Provisions of Bidding documents are clear and shall prevail.

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73.	Section-IV, GCC	37.6	46/57	If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the currency of the Contract, the parties will attempt to develop a mutually satisfactory solution, failing which the dispute shall be resolved in accordance with GCC Clause 6.	We request Employer to modify the clause as follows: If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the currency of the Contract, <u>either of the parties shall have a right to terminate the Contract by giving a written notice to the other Party</u> will attempt to develop a mutually satisfactory solution, failing which the dispute shall be resolved in accordance with GCC Clause 6.	Provisions of Bidding documents are clear and shall prevail.
74.	Section-IV, GCC	38.2	47/57	if such destruction, damage, injury or loss of life is caused by any War Risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges or expenses arising in consequence of or in connection with the same.	We request Employer to modify the clause as follows: if such destruction, damage, injury or loss of life is caused by any War Risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges or expenses arising in consequence of or in connection with the same.	Provisions of Bidding documents shall prevail.

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75.	Section-IV, GCC	39.2.3	49/57	If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Form of Contract Agreement by more than fifteen (15) percent, the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer and the Contractor shall agree on specific rates for valuation of the change.	We request Employer to modify the clause as follows: If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Form of Contract Agreement by more than fifteen (15) percent, the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, ~~the Employer and the Contractor shall agree on specific rates for valuation of the change. the Employer shall withdraw the proposed Change and shall notify the Contractor in writing thereof. The Contractor's failure to so object shall neither alter its right to object to any subsequent requested Changes or Change Order herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.~~	Provisions of Bidding documents shall prevail.

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76.	Section-IV, GCC	40.1	49/57	The Time(s) for Completion specified in the SCC shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following: (a) (b) (c) (d) (e) (f) any other matter specifically mentioned in the Contract; by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.	We request Employer to modify the clause as follows: The Time(s) for Completion specified in the SCC shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following: (a) (b) (c) (d) (e) (f) any other matter specifically mentioned in the Contract <u>or mutually agreed by the Parties;</u> <u>(g) Delay caused for any reason not attributable to the Contractor</u> by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor. <u>The price implications, if any, due to Extension of Time for Completion shall be paid / reimbursed by the Employer to the Contractor in addition to the Contract Price, except in the case of Force Majeure or those which are compensated by the respective provisions of the Contract.</u>	Provisions of Bidding documents shall prevail.

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77.	Section-IV, GCC	41.5	53/57	NEW CLAUSE	We request Employer to introduce a new clause as given below: <u>41.5 Notwithstanding GCC Clause 41.1 & 41.2, Suspension shall not apply to any obligation of the Employer to make payments to the Contractor for the works already executed / material despatched.</u>	Provisions of Bidding documents shall prevail.
78.	Section-IV, GCC	41.6	52/57	NEW CLAUSE	We request Employer to introduce a new clause as given below: <u>41.6 If the Suspension continues for an aggregate period exceeding ninety (90) Days, due to reasons solely attributable to the Employer, the Contractor shall have the option to terminate this Contract. In the event the Contractor opts for such termination, the Employer shall pay the Contractor the proportionate price for work completed upto such termination and reasonable compensation towards such termination.</u>	Provisions of Bidding documents shall prevail.

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79.	Section-IV, GCC	41	51/57	SUSPENSION	We request Employer that in case of any suspension which is not attributable to the Contractor, the Employer shall provide to Contractor an extension of time (for a period which is not less than the suspension period) and the compensation of reasonable costs incurred during such suspension i.e. the cost of work in progress, procured materials, storage and maintenance of Works etc.	Provisions of Bidding documents shall prevail.
80.	Section-IV, GCC	42.1.1	52/57	The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Sub Clause 42.1.	We request Employer to modify the clause as follows: The Employer may at any time terminate the Contract for any reason by giving the Contractor a <u>written</u> notice <u>at least 30 days prior of to</u> termination <u>and the reasons</u> that refers to this GCC Sub Clause 42.1.	Provisions of Bidding documents shall prevail.
81.	Section-IV, GCC	42.1.2	52/57	Upon receipt of the notice of termination under GCC Sub Clause 42.1.1, the Contractor shall either immediately or upon the date specified in the notice of termination.....	We request Employer to modify the clause as follows: Upon receipt of the notice of termination under GCC Sub Clause 42.1.1, the Contractor shall <u>as soon as practicable</u> ~~<u>either immediately</u>~~ or upon the date specified in the notice of termination.....	Provisions of Bidding documents shall prevail.

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82.	Section-IV, GCC	42.1.3 (b)	53/57	the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel	We request Employer to modify the clause as follows: the costs reasonably incurred by the Contractor in the removal of the <u>temporary work and</u> Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel	Provisions of Bidding documents shall prevail.
83.	Section-IV, GCC	42.1.3	53/57	Termination for Employer's Convenience	We request Employer to add an item (f) in this clause as follows: (f) <u>Cost for work in progress, procured material, storage and maintenance</u>	Provisions of Bidding documents shall prevail.
84.	Section-IV, GCC	42.2.1	53/57	The Employer, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons therefor to the Contractor, referring to this GCC Sub Clause 42.2: (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or	We request Employer to modify the clause as follows: The Employer, ~~without prejudice to any other rights or remedies it may possess,~~ may terminate the Contract ~~forthwith~~ in the following circumstances by giving a <u>prior written</u> notice of termination <u>of not less than 30 days</u> and its reasons therefor to the Contractor, referring to this GCC Sub Clause 42.2 <u>which shall at all times be preceded by a reasonable period of time notified to the Contractor for remedying or rectifying the said default:</u> (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it,	Provisions of Bidding documents shall prevail.

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				reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43 (Assignment). (c) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.	compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, ~~or if the Contractor takes or suffers any other analogous action in consequence of debt~~ (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43 (Assignment). (c) if it is proven that the Contractor, ~~in the judgment of the Employer~~ has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.	
85.	Section-IV, GCC	42.2.2 (d)	54/57	refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program furnished under GCC Clause 18 (Program of Performance) at rates of progress that give reasonable assurance to the Employer that the Contractor can	We request Employer to modify the clause as follows: refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program furnished under GCC Clause 18 (Program of Performance) at rates of progress that	Provisions of Bidding documents shall prevail.

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				attain Completion of the Facilities by the Time for Completion as extended	give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended <u>and after considering additional period by which the ceiling limit for liquidated damages for delay can be reached.</u>	
86.	Section-IV, GCC	42.2.3	54/57	Termination for Contractor's Default (e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities.	We request Employer to modify the clause as follows: (e) deliver to the Employer all <u>non-proprietary</u> drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities. <u>Such documents and any intellectual property rights therein shall remain under the Contractor's ownership.</u>	The provisions of bidding documents shall prevail. Bidder may also refer GCC Clause 15 & 16.
87.	Section-IV, GCC	42.2.6	55/57	If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined. If the sum that the Contractor is entitled to be paid, pursuant to GCC Sub Clause 42.2.5, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the	Since, the Contractor's liability is limited to total Contract Price as per SCC Clause No. 23 [GCC Clause 30.1(b)] Therefore, we request Employer to delete this clause.	Provisions of Bidding documents shall prevail.

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				Contractor shall be liable for such excess. If such excess is greater than the sums due to the Contractor under GCC Sub Clause 42.2.5, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due to the Contractor under GCC Sub Clause 42.2.5, the Employer shall pay the balance to the Contractor. The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.		
88.	Section-IV, GCC	42.3.3	57/57	Termination by Contractor (d)...(iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.	We request Employer to modify the clause as follows: (d)...(iii) deliver to the Employer all <u>non-proprietary</u> drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.	The provisions of bidding documents shall prevail. Bidder may also refer GCC Clause 15 & 16.

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89.	Section-IV, GCC	43.1	57/57	Assignment The Contractor shall not, without the express prior written consent of the Employer, assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or there under, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.	We request Employer to modify the clause as follows: The Employer or the Contractor shall not, without the express prior written consent of the other party Employer , assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or there under, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.	Provisions of Bidding documents shall prevail.
90.	Section-V, SCC	5.0 [GCC Clause-7.3.1.9]	3/31	The prices of all future requirements of item of spares manufactured by contractor / SG manufacturer beyond 3 years operational requirement will be derived from the corresponding ex-works price at which the order for such spares have been placed by Employer as a part of mandatory spares or recommended spares, or from the rates of mandatory spares or recommended spares as quoted by/negotiated with the Contractor. Ex-works order price of future spares shall be computed in accordance with the price adjustment provisions covered under the main Contract excepting that the base indices will be counted from the scheduled date	No escalation formulae can give a fair & correct estimation of prices for such a long duration. Hence, we request that the prices for such long-term spares shall be sought afresh by the Employer as and when desired so. <u>Alternatively</u> , we request Employer to modify the clause as follows: Subject to mutual agreement between Parties, The <u>the</u> prices of all future requirements of item of spares manufactured by contractor / SG manufacturer beyond 3 years operational requirement will be derived from the corresponding ex-works price at which the order for such spares have been placed by Employer as a part of	Provisions of Bidding documents shall prevail.

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				of Commissioning of the last equipment under the main project and there will be no ceiling on the amount of variation in the prices. The above option for procuring future recommended spares by the Employer shall remain valid for the period of 5 years from the date of Commissioning of the equipment.	mandatory spares or recommended spares, or from the rates of mandatory spares or recommended spares as quoted by/negotiated with the Contractor. Ex-works order price of future spares shall be computed in accordance with the price adjustment provisions covered under the main Contract excepting that the base indices will be counted from the scheduled date of ~~Commissioning of the last equipment under the main project~~ supply of Mandatory Spares and there will be no ceiling on the amount of variation in the prices. The above option for procuring future recommended spares by the Employer shall remain valid for the period of 5 years from the date of Commissioning of the equipment.	
91.	Section-V, SCC	6.0	4/31	"Completion of Facilities" for Unit-1 & Common System for the Project shall be attained within 46 months from the date of Notification of Award. There will be a gap of 6 months in completion of facilities for subsequent Units.	1. Time schedule specified in Appendix-4 to the Form of Contract Agreement reflects Completion of Facilities 44 months. 2. BDS clause 9.0 reflects Time for Completion of Facilities from the date of Notification of Award shall be 46 & 52 months for Unit 1 & Unit 2 respectively. However, Milestone schedule for Steam Turbine & Auxiliaries shows finish period of 44 months for Completion of facilities of Unit #1.	Completion of Facilities is 44 months for Unit 1 with a phase gap of 6 months for Unit-II. Please refer Amendment No. 5 to the Bidding Documents in this regard.

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					3. Attachment-14 – Major Activities/Milestone Chart shows for 46 months for Completion of facilities for Unit #1. In view of above discrepancy, we understand that the schedule as per Attachment-14 is correct i.e. 46 months for Completion of facilities for Unit #1 with a gap of 6 months in completion of facilities for Unit#2 & will supersede other schedules. Kindly clarify.	
92.	Section-V, SCC	7.0 [GCC Clause-13.2.2.]	4/31	The security shall be in the form of an unconditional bank guarantee as per the proforma provided in Section VII (Forms and Procedures) - Form of Down Payment Security. The Down payment Security shall be reduced prorata every three (3) months after First Running Account Bill/Stage Payment under the Contract based on the value of the respective equipment/facilities received and applicable GST. The cumulative amount of reduction at any point of time shall not exceed ninety percent (90%) of the Down payment and the amount of GST paid on the Down amount corresponding to cumulative value of the respective	We request Employer to modify the clause as follows: The security shall be in the form of an unconditional bank guarantee as per the proforma provided in Section VII (Forms and Procedures) - Form of Down Payment Security. The Down payment Security shall be reduced prorata every three (3) months after First Running Account Bill/Stage Payment under the Contract based on the value of the respective equipment/facilities received and applicable GST. <u>This reduction shall be done until the value of Down Payment Security reduces to zero.</u> ~~The cumulative amount of reduction at any point of time shall not exceed ninety~~	Provisions of Bidding documents shall prevail.

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				equipment/Facilities supplied and received as per certificate issued by the Project Manager. The balance shall be released after ninety (90) days beyond Completion of those Facilities. It should be clearly understood that reduction in the value of security for Down payment shall not in any way dilute the Contractor's responsibility and liabilities under the Contract including in respect of the Facilities for which the reduction in the value of security is allowed.	~~percent (90%) of the Down payment and the amount of GST paid on the Down amount corresponding to cumulative value of the respective equipment/Facilities supplied and received as per certificate issued by the Project Manager. The balance shall be released after ninety (90) days beyond Completion of those Facilities. It should be clearly understood that reduction in the value of security for Down payment shall not in any way dilute the Contractor's responsibility and liabilities under the Contract including in respect of the Facilities for which the reduction in the value of security is allowed.~~	
93.	Section-V, SCC	8.0	5/31	Values of the Contract Performance Securities furnished by Main Contractor and its Assignee (if applicable) shall be reduced to 67% and 34% of their original values on expiry of ninety (90) days after actual completion of defect liability period of all facilities relating to Unit-I and Unit-II respectively.	We request Employer to modify the clause as follows: Values of the Contract Performance Securities furnished by Main Contractor and its Assignee (if applicable) shall be reduced to 67% and ~~34%~~ 33% of their original values on expiry of ~~ninety forty-five (90 45)~~ days after actual completion of defect liability period of all facilities relating to Unit-I and Unit-II respectively.	Provisions of Bidding documents shall prevail.

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94.	Section-V, SCC	14	8/31	 The Contractor shall also indemnify to keep the Employer harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of scrap. The Indemnity -cum-Undertaking Agreement shall be furnished by Contractor as per proforma enclosed in Section-VII (Forms and Procedure). Further, in case the laws require the Employer to take prior permission of the relevant Authorities before handing over the scrap to the Contractor, the same shall be obtained by the Contractor on behalf of the Employer.	Since, an indemnity provision for non-compliance of laws is already covered under GCC Clause-9.4, we request Employer to modify the provision as follows: ~~The Contractor shall also indemnify to keep the Employer harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of scrap. The Indemnity-cum-Undertaking Agreement shall be furnished by Contractor as per proforma enclosed in Section VII (Forms and Procedure).~~ Further, in case the laws require the Employer to take prior permission of the relevant Authorities before handing over the scrap to the Contractor, the same shall be obtained by the Contractor on behalf of the Employer.	Provisions of Bidding documents shall prevail.
95.	Section-V, SCC	17	9/31	If for reasons attributable to the Employer, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period of 12 months from the date of Completion of respective facility, the payment towards Successful Completion of Guarantee Test, shall be released to the	We request the Employer to modify the clause as follows: If for reasons not attributable to the ~~Employer~~ Contractor , the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period of 12 three (03) months from the date of Completion of respective	Provisions of Bidding documents shall prevail.

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				contractor against Bank Guarantee. Such Bank Guarantee shall have initial validity of one (1) year. The Bank Guarantee shall be extended for any subsequent period, if required, such that the same remains valid till the successful Completion of Guarantee Test.	facility, the payment towards Successful Completion of Guarantee Test, shall be released to the contractor against Bank Guarantee. Such Bank Guarantee shall have initial validity of six (6) months one (1) year . ~~The Bank Guarantee shall be extended for any subsequent period, if required, such that the same remains valid till the successful Completion of Guarantee Test. Beyond this period, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Sub-Clauses 28.2 and 28.3 shall not apply.~~	
96.	Section-V, SCC	18	9/31	Subject to GCC Sub-Clause 25.4 (Partial Acceptance) below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when (a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or (b) the Contractor has paid the liquidated damages (if any) specified in GCC Sub-Clause 28.3 hereof; and	We request Employer to modify the clause as follows: Subject to GCC Sub-Clause 25.4 (Partial Acceptance) below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when (a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or (b) <u>the Guarantee Tests have not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the</u>	Provisions of Bidding documents shall prevail.

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				(c) any minor items mentioned in GCC Sub-Clause 24.7 hereof	<u>period from the date of Completion specified in the SCC or any other agreed upon period as specified in GCC Sub Clause 25.2.2, but successful Completion of the Facilities has been achieved; and</u> ~~(b) the Contractor has paid the liquidated damages (if any) specified in GCC Sub-Clause 28.3 hereof; and~~ (c) any minor items mentioned in GCC Sub-Clause 24.7 hereof	
97.	Section-V, SCC	19	10/31	iii) Maximum deduction for Liquidated Damages: The total amount of Liquidated Damages for delay under the contracts will be subject to a maximum of five percent (5%) of the total contract price (Total of First, Second & Third contract).	We understand that Liquidated Damages (LD) shall be applicable unit wise; therefore, the cap on LD shall also be unit wise i.e. <u>5% of 1/2 of the Total Contract Price.</u> Kindly confirm.	Provisions of Bidding documents shall prevail.
98.	Section-V, SCC	20	10/31	The third party, so engaged by the Employer, shall be paid fee plus reasonable expenditures incurred in the execution of its duties as mentioned above. These costs shall be initially paid by the Employer. In	There is no mention of amount of fees in the clause. Kindly clarify.	Provisions of Bidding documents are clear and shall prevail.

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				case of latent defect being proved, such costs shall be recoverable from the Contractor and the Contractor shall bear and reimburse such costs to the Employer.....		
99.	Section-V, SCC	21	10/31	The critical components covered under the extended warranty as specified in Technical Specification are the mill wear parts. Further, in case the Steam Turbine Generator Manufacturer has an evaporator in the reference Steam Turbine Generator designed for constant pressure (universal pressure) operation only and has an ongoing license agreement (which covers technology transfer) with the original Technology Owner (licensor) for design, manufacture, sell, use, service of once through variable pressure super critical steam turbine generator technology (with evaporator suitable for variable pressure operation in sub-critical and super critical pressure ranges), Contractor shall furnish an extended warranty of atleast one year for successful performance of Steam Turbine Generator as detailed in the Technical Specification.	We understand the said clause is not applicable for Steam Turbine Generator package and the same may please be deleted.	Bidder's understanding is correct. Please refer Amendment No. 5 to the Bidding Documents.

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100.	Section-V, SCC	24	11/31	 The Contractor shall also indemnify to keep the Employer harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of surplus material. The Indemnity-cum-Undertaking Agreement shall be furnished by contractor as per proforma enclosed in Section-VII (Part 3 of 3 - Forms and Procedures). Further, in case the laws require the Employer to take prior permission of the relevant Authorities before handing over the surplus material to the Contractor, the same shall be obtained by the Contractor on behalf of the Employer.	Since, an indemnity provision for non-compliance of laws is already covered under GCC Clause-9.4, we request Employer to modify the provision as follows: ~~The Contractor shall also indemnify to keep the Employer harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of surplus material. The Indemnity-cum-Undertaking Agreement shall be furnished by contractor as per proforma enclosed in Section-VII (Part 3 of 3 - Forms and Procedures).~~ Further, in case the laws require the Employer to take prior permission of the relevant Authorities before handing over the surplus material to the Contractor, the same shall be obtained by the Contractor on behalf of the Employer.	Provisions of Bidding documents shall prevail.
101.	Section-V, SCC	26	11/31	Documents for Consideration of Time Extension	We request the Employer to delete this clause.	Provisions of Bidding documents shall prevail.
102.	Section-V, SCC	27	12/31	The Bank Guarantee and Insurance charges for the extended period on account of delays attributable to the Employer shall be reimbursed at the following rates: Rate applicable for : 0.25% p.a. +	1. Employer may be aware that recently majority of the banks have substantially increased the rates of Bank Guarantee Charges. These new rates of BG Charges are much higher than the rate specified in this clause for reimbursement of Bank Guarantee	1. Provisions of Bidding documents shall prevail. 2. Provisions of Bidding documents shall prevail.

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			reimbursement of BG or actual, which Charges ever is lower account of delays attributable to the subject to Employer. We, therefore, request documentary evidence. Employer to suitably increase this rate in line with prevailing rates in the market. Rate applicable for Insurance Charges: as per tables below : (I) Basic Rates* : (II) Additional Cover*: In addition to above the rate of premium applicable for 'Earthquake' and 'Terrorism' cover shall be as under: * Notes: i) ii) iii) iv) The Insurance charges shall be reimbursable on the rates as above or actual, whichever is lower, subject to the documentary evidence.	Charges for the extended period on account of delays attributable to the Employer. We, therefore, request Employer to suitably increase this rate in line with prevailing rates in the market. 2. The rate of Insurance Charges to be reimbursed by the Employer on account of delay attributable to Employer shall depend on various factors e.g. claims lodged, duration of extension, sum insured, reason for extension etc. Hence, pre-agreed rates of Insurance Charges (Basic Rates & Additional Cover both) shall not be feasible. We, therefore request Employer to reimburse the Insurance Charges on the rates as actual.	

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				v) Taxes shall be paid over and above the rates as indicated.		
103.	Section-V, SCC	31.4.9	19/31	The Contractor, including his sub-contractors, while executing the Works, will strictly comply with the statutory requirements (including amendments thereof), as applicable, in respect of safety of his employees, equipment and materials. The contractor will also comply with the provisions of Safety Rules as attached as Annexure-II to SCC.	Safety Rules as attached in Annexure-II to SCC pertains to NTPC. We request Employer to modify the same according to this tender for <i>"Turbine Generator and Associated Packages for Khurja Super Thermal Power Project (2X660 MW) of THDC India Limited."</i>	Provisions of Bidding documents shall prevail. As NTPC is the Employer's consultant for this package, Bidders to follow the safety provisions enclosed with the Bidding documents.
104.	Section-V, SCC	39.1	21/31	Training of Apprentices:	We request Employer to clarify the number of apprentices to be trained and if this is part of the training requirement of Employer's personnel covered in the technical specification.	Provisions of Bidding documents shall prevail. The number of apprentices to be trained may be discussed with the Employer after the award of the Contract. Further, Training of Apprentices will be taken up by the Contractor as per clause 39 of SCC and the same is not to be considered as part of the training requirement of Employer's personnel covered in the technical specification.

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105.	Section-V, SCC	45	21/31	Royalty	1) We understand that this clause is applicable on material which is brought by Contractor from outside plant boundary and not applicable on the material excavated & used within the plant boundary. Please confirm. 2) Moreover, in case the excavated material is to be dumped outside the plant premises, then all clearance shall be arranged by Employer and Royalty / Seigniorage Fee or Cess or Other Charges, if any applicable along with transportation charges shall be borne by the Employer. Kindly confirm.	1. Bidder may refer clause 45 of Section-V (SCC) regarding Royalty and quote their prices accordingly. However, in case Royalty is levied on earth excavated by contractor during construction works within the plant premises, the same will be paid by the Bidder and reimbursed by the Employer upon submission of documentary evidence by the Bidder. 2. Bidder may refer clause 45 of Section-V (SCC) regarding Royalty and quote their prices accordingly. 3.
106.	Section-V, SCC	45	22/31	2.4 The Contractor shall pay and indemnify the Employer against any default in payment of Royalties or Seigniorage Fee or Cess or other charges by the Contractor or the agency from which the Contractor purchases soil/earth, sand, stone/aggregates, metals, minerals or minor minerals.	Since, an indemnity provision for non-compliance of laws is already covered under GCC Clause-9.4, we request Employer to delete this clause.	Provisions of Bidding documents shall prevail.

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107.	Section-V, SCC	55 [GCC Clause- 6.1]	25- 26/31	If the Contractor considers any work demanded his written instructions or decision within a period of thirty days of such request. Upon receipt of the written instructions with such instructions or decision. If the Engineer-in-charge fails to give in writing to the contractor within thirty days after the receipt of the Contractor's written appeal. If the contractor is still dis-satisfied refer the matter to the Arbitration	We request Employer to replace the entire clause with the following: In case of any dispute(s) arising out of or in connection with the Contract, the Parties shall try to amicably settle the said dispute(s) within 30 days.	Provisions of Bidding documents shall prevail.
108.	Section-V, SCC	55 [GCC Clause- 6.2.1]	26/31	In case the parties fail to settle the dispute as per GCC Sub-Clause 6.1 above, either party may give a notice to the other party, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. Such notice of intention to commence arbitration shall be given within a period of fifteen (15) days from the date of failure to settle the matter as per GCC Sub-Clause 6.1.	We request Employer to modify the clause as follows: In case the parties fail to settle the dispute as per GCC Sub-Clause 6.1 above, either party may give a notice to the other party, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. Such notice of intention to commence arbitration shall be given within a period of thirty (30) fifteen (15) days from the date of failure to settle the matter as per GCC Sub-Clause 6.1.	Provisions of Bidding documents shall prevail.

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109.	Section-V, SCC	55 [GCC Clause- 6.2.1]	26/31	The mechanism of settling the disputes through arbitration shall be applicable only in cases where the disputed amount (i.e. total amount of Claims excluding claims of interest) does not exceed Rs. 25 crores. In case the disputed amount exceeds Rs. 25 Crores, the parties shall be within their rights to take recourse to remedies as may be available to them under the applicable laws other than Arbitration after prior intimation to the other party. There shall be no arbitration where the claim amount is only up to Rs. 5 lakhs.	There should not be any upper limit of claim amounts for settling of disputes through arbitration. Hence, we request to remove the limit of Rs. 25 Crores and further modify the clause as follows. ~~The mechanism of settling the disputes through~~ <u>The</u> arbitration shall be <u>conducted in accordance with the Arbitration and Conciliation Act, 1996 to be read along with its subsequent amendments, re-enactments thereto and the Rules framed thereunder.</u> ~~applicable only in cases where the disputed amount (i.e. total amount of Claims excluding claims of interest) does not exceed Rs. 25 crores. In case the disputed amount exceeds Rs. 25 Crores, the parties shall be within their rights to take recourse to remedies as may be available to them under the applicable laws other than Arbitration after prior intimation to the other party. There shall be no arbitration where the claim amount is only up to Rs. 5 lakhs.~~ <u>The Arbitral Tribunal shall consist of three (3) arbitrators, each Party to appoint one arbitrator and the two such appointed arbitrators to appoint the presiding arbitrator. The venue of arbitration shall be Delhi. The arbitration proceedings shall be conducted in English language.</u>	Provisions of Bidding documents shall prevail.

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110.	Section-V, SCC	55 [GCC Clause- 6.2.1]	26/31	The parties at the time of invocation of arbitration shall submit all the details of the claims and the counter-claims including the Heads/Subheads of the Claims/Counter Claims and the documents relied upon by the parties for their respective claims and counter-claims. The parties shall not file any documents/details of the claims and counter-claims thereafter. The claims and the counter claims raised by the parties at the time of invocation of the arbitration shall be final and binding on the parties and no further change shall be allowed in the same at any stage during arbitration under any circumstances whatsoever.	The arbitration process shall be driven by Arbitration & Conciliation Act 1996 and any amendment thereof. We therefore request the Employer to delete the said provisions accordingly.	Provisions of Bidding documents shall prevail.
111.	Section-V, SCC	55 [GCC Clause- 6.2.1]	27/31	The parties to the contract shall invoke arbitration within Six months from the date of completion of the Facilities under the contract or the termination of the contract as the case may be and the parties shall not invoke arbitration later on after expiry of the said period of six months. The parties shall not invoke arbitration other than in the case of completion of the Facilities or the termination of the contract as mentioned above.	In line with provisions available in other Central/State Utility Tenders, we request Employer that the Contractor should be allowed to invoke arbitration at any time during the course of contract. Therefore, there should not be any restriction of six months from date of Completion of Facilities or termination of contract to invoke arbitration. In view of the above we request Employer to delete this clause.	Provisions of Bidding documents shall prevail.

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112.	Section-V, SCC	55 [GCC Clause- 6.2.3]	27/31	Any dispute raised by a party to arbitration shall be adjudicated by a Sole Arbitrator appointed by CMD, THDCIL in the following manner: - a) A party willing to commence arbitration proceeding shall invoke Arbitration Clause by giving 60 days notice to the other party. b) If the Arbitrator so appointed dies, resigns, becomes incapacitated or withdraws for any reason from the proceedings, it shall be lawful for CMD, THDCIL to appoint another person in his place in the same manner as aforesaid. Such person shall proceed with the reference from the stage where his predecessor had left.....	We request Employer to modify the clause as follows: Any dispute raised by a party to arbitration shall be adjudicated by ~~a Sole~~ the Arbitrators appointed by the parties ~~CMD, THDCIL~~ in the following manner: - a) A party willing to commence arbitration proceeding shall invoke Arbitration Clause by giving 60 days notice to the other party. ~~b) If the Arbitrator so appointed dies, resigns, becomes incapacitated or withdraws for any reason from the proceedings, it shall be lawful for CMD, THDCIL to appoint another person in his place in the same manner as aforesaid. Such person shall proceed with the reference from the stage where his predecessor had left.....~~	Provisions of Bidding documents shall prevail.
113.	Section-V, SCC	55 [GCC Clause- 6.2.3]	27/31	d) Arbitrator shall be paid fees at the following rates: If the claim is in foreign currency, the SBI Bills Selling Exchange rate prevailing on the date of claim shall be used for the purpose of converting the claim in Indian	Arbitrators' Fee shall be in line with the Arbitration and Conciliation Act, 1996 as amended. The same cannot be decided in the Contract. We therefore request Employer to delete this clause.	Provisions of Bidding documents shall prevail.

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				Rupee which may be used for determining the arbitration fee as brought out above .		
114.	Section-V, SCC	55 [GCC Clause- 6.2.3]	28/31	e) If after commencement of the Arbitration proceedings, the parties agree to settle the dispute mutually, the arbitrator shall put the proceedings in abeyance until such period as requested by the parties. Where the proceedings are put in abeyance or terminated on account of mutual settlement of dispute by the parties, the fees payable to the arbitrator shall be determined as under: (i) 40% of the fees if the Pleadings are complete. (ii) 60% of the fees if the Hearing has commenced. (iii) 80% of the fees if the Hearing is concluded but the Award is yet to be passed.	We request Employer to modify the clause as follows: If after commencement of the Arbitration proceedings, the parties agree to settle the dispute mutually, the arbitrator shall put the proceedings in abeyance until such period as requested by the parties. Where the proceedings are put in abeyance or terminated on account of mutual settlement of dispute by the parties, the fees payable to the arbitrator shall be determined as <u>per mutual discussion between the parties</u> under: ~~(i) 40% of the fees if the Pleadings are complete.~~ ~~(ii) 60% of the fees if the Hearing has commenced.~~ ~~(iii) 80% of the fees if the Hearing is concluded but the Award is yet to be passed.~~	Provisions of Bidding documents shall prevail.

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115.	Section-V, SCC	55 [GCC Clause- 6.2.3]	28/31	f) Each party shall pay its share of arbitrator's fees in stages as under: (i) 40 % of the fees on Completion of Pleadings. (ii) 40% of the fees on Conclusion of the Final Hearing. (iii) 20% at the time when arbitrator notifies the date of final award.	We request Employer to delete this clause.	Provisions of Bidding documents shall prevail.
116.	Section-V, SCC	55 [GCC Clause- 6.5]	29/31	No Claim for interest owing to dispute delay etc. No claim for interest or damage will be entertained or be payable by the corporation in respect of any amount or balance which may be lying with the corporation or may become due 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 payment or in respect of any amount/ damage which may be	We request Employer to delete this clause.	Provisions of Bidding documents shall prevail.

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				claimed through arbitration or in any other respect whatsoever".		
117.	Section-V, SCC	56	29/31	If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be referred to Director (Technical), THDCIL for determination in accordance with GCC Sub-Clause 6.1 hereof. If such dispute or difference is referred to Director (Technical), THDCIL, the Project Manager shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Director (Technical), THDCIL upholds the Contractor's view on the dispute and if the Employer has not given notice under GCC Sub Clause 6.2.1 hereof,	We request Employer to modify the clause as follows: If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be referred to <u>a third party expert mutually agreed by Parties</u> Director (Technical), THDCIL for determination in accordance with GCC Sub-Clause 6.1 hereof. If such dispute or difference is referred to Director (Technical), THDCIL, the Project Manager shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Director (Technical), THDCIL. <u>If the third party expert</u> upholds the Contractor's view on the dispute and if the Employer has not given notice under GCC	Provisions of Bidding documents shall prevail.

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				then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Director (Technical), THDCIL shall decide, and the Time for Completion shall be extended accordingly.	~~Sub Clause 6.2.1 hereof, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Director (Technical), THDCIL shall decide,~~ and the Time for Completion shall be extended accordingly.	
118.	Section-V, SCC	57	29/31	If any dispute or difference of opinion shall arise between the parties in connection with or arising out of the test and/or inspection of the Plant and Equipment or part of the Facilities that cannot be settled between the parties within a reasonable period of time, it may be referred to the Director (Technical), THDCIL for determination in accordance with GCC Sub- Clause 6.1.	We request Employer to modify the clause as follows: If any dispute or difference of opinion shall arise between the parties in connection with or arising out of the test and/or inspection of the Plant and Equipment or part of the Facilities that cannot be settled between the parties within a reasonable period of time, it may be referred to the ~~Director (Technical), THDCIL~~ <u>third party expert who is mutually appointed by the Parties</u> for ~~determination in accordance with GCC Sub Clause 6.1.~~	Provisions of Bidding documents shall prevail.

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119.	Section-V, SCC	60	30/31	For payments related to Erection / Civil / Site Fabricated Structural works: A single designated ESCROW account shall be opened by the Contractor 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 the Contractor shall be released into abovementioned ESCROW account as may be required in the performance of the contract. All expenses/charges shall be paid by the Contractor. The revised draft agreement is annexed for executing Escrow Account Agreement. The Detailed Operative Procedure within 15 days of the placement of award.	We understand that the Employer is concerned about payments being rightly utilized by the Contractor during implementation of Contract. However, considering bidder's financial soundness and practice of fair utilization of payments for various completed and ongoing projects, bidder would not be able to accept such provisions as: a) With such Escrow account provisions, we will not be able to manage desired cash flow requirements of the project. b) Payments to the suppliers are managed at corporate level with internal debits to divisions based on time to time requirement Therefore, the provision of Escrow account should be removed since the same is not tenable for the bidder.	Provisions of Bidding documents shall prevail.

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120.	Section-VII, Book 1 of 3	BID FORM: Stage-I (Techno- Commer- cial) Bid	3/7	2.0 Attachments to the Bid Form Stage-I (Techno-Commercial) Bid : (w) Attachment 23 : Checklist of Documents to be submitted for Techno-Commercial Bid alongwith a copy of amendments/ addenda/ corrigenda/ errata/ clarification to the bidding documents.	We understand the <u>“copy of amendments/addenda/corrigenda/errata/clarification”</u> is not required to be submitted online, since these documents shall be available on Employer’s online portal www.eprocure.gov.in. Kindly confirm.	Provisions of Bidding documents shall prevail.
121.	Section-VII, Book 1 of 3	Attachm- ent-3A8	1/3	Title Description of Attachment-3A8	The Tender stipulates requirements of adjudication of all the instruments/documents executed outside India as per Section 18 of Indian Stamp Act. As per Qualification Requirement stated in IFB, we need to furnish “Attachment - 3A8” separately executed by the Qualified Steam Turbine Generator Manufacturer & Qualified Generator Manufacturer. These documents will be executed by our Associates MHPS and MELCO in Japan and thereafter will have to be adjudicated by the Collector of Stamps in Ahmedabad (India). Process of adjudication demands establishment of links between the Bidder and the Associate who signs the	Provisions of Bidding documents shall prevail.

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					Attachment (i.e. Attachment-3A8) and also the Bidder's local presence where the adjudication process is to be carried out. Accordingly, we request you to kindly modify the title description of the document concerned (i.e. Attachment-3A8) by adding following in the title: <u>"Pursuant to the Bid Submitted by (Name of the bidder), having its Registered Office at and Power Business Office at"</u> Above changes have been accepted by Other Central/State utilities in their tenders.	
122.	Section-VII, Book 1 of 3	Attachment- 14	-	Milestone Schedule	We understand that this 'Milestone Schedule' provides major guidelines for project execution. Intermediate milestones may vary as per standard execution practices and erection regime of Contractor and OEMs. Bidder requests that bidder should be allowed to make minor changes in the intermediate milestones without changing the overall project milestone schedule. Kindly confirm.	The milestones indicated in work schedule are based on the experience gathered from various projects being executed by our Consultant. However, any minor changes in intermediate milestones may be discussed at L2 level, but, the same to be properly justified by the contractor and agreed to by the Employer.

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123.	Section-VII, Book 1 of 3	Attachment- 311	-	Attachment- 311 (Technology Support Agreement)	We understand that said Attachment-311 is required to be provided by only those bidders qualifying through Route-6 stipulated under Clause-1.6.0 of Item No. 4.0 of BDS. Kindly confirm.	Bidder's understanding is correct.
124.	Section-VII, Book 2 of 3	BID FORM STAGE-II (PRICE) BID [Sl. No.- 15.0]	8/8	We confirm that we have quoted the mandatory spares price on CIF/Ex-works basis for grinding elements for coal pulverisers along with Attachment-6(P) which shall be considered for evaluation of bids. Further, we confirm that quoted mandatory spares price of grinding elements for coal pulverisers indicated in Attachment-6(P) is included in the total price of all the mandatory spares of Steam Generator and Auxiliaries quoted by us in Schedule-1/Schedule-2.	The referred provision is not applicable for this package. Hence, Bidder requests Employer to kindly delete this provision.	Please refer Amendment No. 5 to the Bidding Documents in this regard.
125.	Section-VII, Book 2 of 3	SCHEDULE – 7A	1/1	Schedule No. 7A: Goods and Services Tax (GST)	We request Employer to modify the same as follows: “Schedule No. 7A: <u>Import duty and Goods and Services Tax (GST)</u>”	Please refer Amendment No. 5 to the Bidding Documents in this regard.
126.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-2 (iii)	1/14	Only following components of the Contract Price will be subject to Price adjustment: (a) Ex-Works (India) Price of Plant and Equipment excluding Mandatory Spares manufactured	Considering long span of the project, we request Employer to extend price adjustment provisions to supply of spares as well and accordingly modify the provision as follows: Only following components of the Contract	Provisions of Bidding documents shall prevail.

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				within the Employer's Country and Type Tests Charges (covered in Schedule 2) and FOB Price Component for Plant and Equipment excluding Mandatory Spares supplied from abroad and Type Tests Charges (covered in Schedule 1). (b) (c) (d)	Price will be subject to Price adjustment: (a) Ex-Works (India) Price of Plant and Equipment excluding and Mandatory Spares manufactured within the Employer's Country and Type Tests Charges (covered in Schedule 2) and FOB Price Component for Plant and Equipment excluding and Mandatory Spares supplied from abroad and Type Tests Charges (covered in Schedule 1). (b) (c) (d)	
127.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	-	-	Form of Contract Agreement	We request employer to add the following in the said format: The Employer, the Contractor are individually referred to as "Party" and collectively as "Parties".	Provisions of Bidding documents shall prevail.
128.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	1.1	-	Contract Documents (Reference GCC Clause 2) The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract: (a) This Contract Agreement and the	We request Employer to insert a new point (c) as under in the Order of precedence. The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:	Provisions of Bidding documents shall prevail.

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				Appendices hereto (b) Notification of Award (c) Special Conditions of Contract (d) General Conditions of Contract (e) Technical Specifications and Drawings (f) The Bid and Price Schedules submitted by the Contractor (g) Procedures (as listed) (h) Integrity Pact (IP) signed between the Employer and the Bidder/Contractor	(a) This Contract Agreement and the Appendices hereto (b) Notification of Award (c) <u>Amendments, clarifications, corrigenda including Minutes of Meetings, Record Notes, and correspondences issued between issuance of IFB and NOA</u> (d) Special Conditions of Contract (e) General Conditions of Contract (f) Technical Specifications and Drawings (g) The Bid and Price Schedules submitted by the Contractor (h) Procedures (as listed) (i) Integrity Pact (IP) signed between the Employer and the Bidder/Contractor	
129.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-1 Sl. No. I	11/29	iii) 100% of applicable Taxes and Duties (other than the custom duty payable as in para (i) above) which are payable by the Employer under the Contract shall be paid/reimbursed to the Contractor or Assignee of foreign Contractor (if applicable) upon receipt of equipment/ spares/ services and on production of satisfactory documentary evidence by the Contractor/Assignee, as applicable.	We request Employer to modify the clause as follows: iii) 100% of applicable Taxes and Duties (other than the custom duty payable as in para (i) above) which are payable by the Employer under the Contract shall be paid/reimbursed to the Contractor or Assignee of foreign Contractor (if applicable) upon ~~receipt~~ <u>dispatch</u> of equipment/ spares/ services and on production of satisfactory documentary evidence by the Contractor/Assignee, as applicable.	Provisions of Bidding documents shall prevail.

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130.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-1 Sl. No. I	11/29	iii) 100% of applicable Taxes and Duties (other than the custom duty payable as in para (i) above) which are payable by the Employer under the Contract shall be paid/reimbursed due upon supply of goods/services, based on the value of the respective goods/services.	Bidder understands that Goods & Services Tax (GST) quoted by the bidder in Schedule No. 7 shall be as applicable in the Employer's country as on seven (7) days prior to the last date for submission of bids. The exchange rate for conversion of foreign currency portion into Indian Rupees shall be as per SBI Bill selling exchange rates as applicable on seven (7) days prior to the last date for submission of price bids. Further, Bidder understands that any variation in Goods and Services Tax (GST) due to exchange rate (with respect to exchange rates as applicable on seven (7) days prior to the last date for submission of bids) shall be paid at actuals by the Employer, beyond the amount quoted in Schedule No. 7. Kindly confirm.	Provisions of Bidding documents shall prevail. Bidder may also refer Clause 14 of GCC (Section-V) in this regard.
131.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-1 Sl. No. I	11/29	Schedule – 7 & 7A: Payment Terms for Taxes & Duties	Bidder understands that the Taxes & Duties applicable on the Price Adjustment amount shall be reimbursed by the Employer over and above the amount quoted in Schedule No. 7 and/ or Schedule No. 7A. Kindly confirm.	Bidder's understanding is correct.

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132.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-1 Sl. No. L	12/29	The advance amounts shall be interest bearing and rate of interest to be notified by the Employer from time to time. This advance shall not be lumpsum advance, but shall be provided in phases to tide over the financial constraints being faced by the contractor, along with the progress of work. The requirement of this advance shall be with the approval of the Employer's Project Manager.	We request Employer to modify the provision as follows: The advance amounts shall be interest <u>free</u> bearing and rate of interest to be notified by the Employer from time to time. This advance shall not be lumpsum advance, but shall be provided in phases to tide over the financial constraints being faced by the contractor, along with the progress of work. The requirement of this advance shall be with the approval of the Employer's Project Manager.	Provisions of Bidding documents shall prevail.
133.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-1 [Clause-5.1]	14/29	The Employer will establish an irrevocable Letter of Credit (L/C) in favour of the Contractor through the Employer's Bank in Employer's country for payments due, as per Terms of Payment, on despatch of equipments including Mandatory Spares i.e. CIF despatch of equipments including Mandatory Spares (including due payments towards Ocean Freight and Marine Insurance).	In line with provisions available in other Central/State Utility Tenders, we request Employer to make payment for Ex-works Supplies through L/C and accordingly modify the clause as follows: The Employer will establish an irrevocable Letter of Credit (L/C) in favour of the Contractor through the Employer's Bank in Employer's country for payments due, as per Terms of Payment, on despatch of equipments including Mandatory Spares i.e. CIF <u>& Ex-works</u> despatch of equipments including Mandatory Spares (including due payments towards Ocean Freight and Marine Insurance).	Provisions of Bidding documents shall prevail.

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134.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Annexur e-3 to Appendi x-1 [Clause- 7.9]	-	The Escrow Bank shall not be held liable for any loss or damage or failure to perform its obligations hereunder, or for any delay in complying with any duty or obligation, under or pursuant to this Agreement arising as a direct or indirect result of any Force Majeure Event.	We request Employer to modify the provision as follows: The Escrow Bank shall not be held liable for any loss or damage or failure to perform its obligations hereunder, or for any delay in complying with any duty or obligation, under or pursuant to this Agreement arising as a direct ~~or indirect~~ result of any Force Majeure Event.	Provisions of Bidding documents shall prevail.
135.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Annexur e-3 to Appendi x-1 [Clause- 9]	-	INDEMNITY	We request Employer to delete this clause.	Provisions of Bidding documents shall prevail.
136.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Annexur e-3 to Appendi x-1 [Clause- 10]	-	The Obligations under this clause shall survive the termination or expiry of this agreement.	We request Employer to modify the provision as follows: The Obligations under this clause shall <u>be in accordance with the main Contract between the Employer and Contractor</u> ~~survive the termination or expiry of this agreement.~~	Provisions of Bidding documents shall prevail.
137.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Annexur e-3 to Appendi	-	Save as provided in Clause __ of the General Conditions of the Contract of the Employer, the Contractor shall not assign or transfer any part of their	We request Employer to modify the provision as follows: ~~Save as provided in Clause __ of the~~	Provisions of Bidding documents shall prevail.

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	Agreement)	x-1 [Clause-11]		respective rights or obligations under this Agreement without the prior consent of the Employer, provided that this shall not prevent Employer from assigning or transferring its rights under this Agreement.	~~General Conditions of the Contract of the~~ The Employer, ~~and~~ the Contractor shall not assign or transfer any part of their respective rights or obligations under this Agreement without the prior consent of the other Party which consent shall not be unreasonably withheld Employer, ~~provided that this shall not prevent Employer from assigning or transferring its rights under this Agreement.~~	
138.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Annexur e-3 to Appendi x-1 [Clause-14]	-	No failure or delay on the part of the Employer in exercising any right, power or privilege hereunder or under Contract shall impair any such right, power or privilege or operate as a waiver the Employer would otherwise have. No notice to or demand on the Contractor in any case shall entitle the Contractor to any other or further notice or demand in similar or other circumstances or constitute a waiver of the rights of the Employer to any other or further action in any circumstances without notice or demand.	We request Employer to modify the provision as follows: No failure or delay on the part of the Employer Parties in exercising any right, power or privilege hereunder or under Contract shall impair any such right, power or privilege or operate as a waiver the Employer Parties would otherwise have. ~~No notice to or demand on the Contractor in any case shall entitle the Contractor to any other or further notice or demand in similar or other circumstances or constitute a waiver of the rights of the Employer to any other or further action in any circumstances without notice or demand.~~	Provisions of Bidding documents shall prevail.
139.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract	Annexur e-3 to Appendi	-	In case any of the party is not a Public Sector Enterprise or a Govt. Department:	We request Employer to modify the provision as follows:	Provisions of Bidding documents shall prevail.

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	Agreement)	x-1 [Clause-18]		The same shall be referred to arbitration of a Sole Arbitrator to be appointed by the Board of the Employer. The Arbitration proceedings shall be conducted in accordance with Arbitration and Conciliation Act, 1996 and any amendment thereto. The Courts at Delhi, to the exclusion of all other courts in India, shall have exclusive jurisdiction to try any matter arising out of or connected with the said arbitration proceedings. The arbitration shall be in English and the venue of the arbitration proceedings shall be at New Delhi. Arbitration may commence prior to or after completion of the Contract.	<del>The same shall be referred to arbitration of a Sole Arbitrator to be appointed by the Board of the Employer. The Arbitration proceedings shall be conducted in accordance with Arbitration and Conciliation Act, 1996 and any amendment, <u>modification or re-enactments</u> thereto. <u>The arbitral tribunal shall consist of three arbitrators, the Employer and the Contractor to appoint one arbitrator each. The two such selected arbitrators to appoint the presiding arbitrator.</u> The Courts at Delhi, to the exclusion of all other courts in India, shall have exclusive jurisdiction to try any matter arising out of or connected with the said arbitration proceedings. The arbitration shall be in English and the venue of the arbitration proceedings shall be at New Delhi. ~~Arbitration may commence prior to or after completion of the Contract.~~</del>	
140.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-3 Note-3	3/3	Any loss or damage to the plant and equipments during handling, transportation, storage, installation, commissioning, and all activities to be performed till the "Completion of Facilities" shall be to the account of the contractor. The contractor shall be responsible for preference of all claims and make good the damages or loss by way of repairs and/or	We request Employer to modify the clause as follows: Any loss or damage to the plant and equipments during handling, transportation, storage, installation, commissioning, and all activities to be performed till the "Completion of Facilities" shall be to the account of the contractor. The contractor shall be responsible for	Provisions of Bidding documents shall prevail.

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				replacement of plant and equipments damaged or lost. Notwithstanding the extent of insurances cover and the amount of claim available from the underwriter, the contractor shall be liable to make good the full replacement/rectification of all the equipments/materials and to ensure their availability as per project requirement without additional financial liability to the Employer.	preference of all claims and make good the damages or loss by way of repairs and/or replacement of plant and equipments damaged or lost. Notwithstanding the extent of insurances cover and the amount of claim available from the underwriter, the contractor shall be liable to make good the full replacement/rectification of all the equipments/materials and to ensure their availability as per project requirement without additional financial liability to the Employer, <u>provided such loss or damage to the plant & equipment occurs due to reasons not attributable to the Employer.</u>	
141.	Section-VII, Book 3 of 3 (Part 1)	Form-2	-	2. Bid Security We, ... the[Name & address of the Bank] having our Head Office at.....(#)..... gurantee and undertake to pay immediately on demand by..... [Name of the Employer] (hereinafter called the 'Employer')..... the amount of(*)..... without any reservation, protest, demand and recourse. Any such demand made by	We request Employer to modify the provision as follows: We, the[Name & address of the Bank] having our Head Office at.....(#)..... gurantee and undertake to pay immediately on demand by..... [Name of the Employer] (hereinafter called the 'Employer')..... the amount of(*)..... without any reservation, protest, demand and recourse. Any such demand made by the 'Employer' shall be conclusive and binding on us irrespective of any dispute or difference	Provisions of Bidding documents shall prevail.

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				the 'Employer' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder. This Guarantee shall be irrevocable and shall remain valid upto(@).....	raised by the Bidder. This Guarantee ~~shall be irrevocable and~~ shall remain valid upto(@).....	
142.	Section-VII, Book 3 of 3 (Part 1)	Form-2	-	2. Bid Security	As per standard practice of bank(s), we request Employer to insert the following provision of "Notwithstanding Clause" in the Bid Security Format: <u>Notwithstanding anything contained hereinabove,</u> <u>Our liability under this guarantee shall not exceed INR.....[amount in words & figures].....</u> <u>This guarantee shall remain valid up to.....[Expiry Date].....</u> <u>Unless a claim in writing is lodged with us before[Claim Date] at[Bank Address]....., all your rights under this guarantee shall stand forfeited and we shall be released and discharged from all liabilities under this guarantee whether or not this document shall have been returned to us.</u>	Provisions of Bidding documents shall prevail.

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143.	Section-VII, Book 3 of 3 (Part 1)	Form- 7(i)	-	7(i).Bank Guarantee Form for Down Payment (Supply-FOB/Ex-Works) The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.	We request Employer to modify the provision as follows: The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity <u>i.e. up to[Date].....</u> <u>This guarantee shall come into effect when the advance payment referred herein above shall be received by the Contractor in his bank account number..... with bank....., and once the funds are received, Contractor will inform the same to the issuing Bank.</u>	Provisions of Bidding documents shall prevail.
144.	Section-VII, Book 3 of 3 (Part 1)	Form-6	-	6.Performance Security Form The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.	We request Employer to modify the provision as follows: The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity <u>i.e. up to[Date].....</u>	Provisions of Bidding documents shall prevail.

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145.	Section-VII, Book 3 of 3 (Part 1)	Form-6, Form- 7(i) & Form-14	-	6.Performance Security Form; 7(i).Bank Guarantee Form for Down Payment (Supply-FOB/Ex-Works); & 14. PROFORMA FOR BANK GUARANTEE TO BE FURNISHED BY THE EXECUTANT OF DEED OF JOINT UNDERTAKING OTHER THAN CONTRACTOR (For Steam Turbine Generator Sets)	As per standard practice of bank(s), we request Employer to replace the provision of “Notwithstanding Clause” in the Bank Guarantee Formats with the following: <u>Notwithstanding anything contained hereinabove,</u> <u>1. Our liability under this guarantee shall not exceed INR.....[amount in words & figures].....</u> <u>2. This guarantee shall remain valid up to.....[Expiry Date].....</u> <u>3. Unless a claim in writing is lodged with us before[Claim Date] at[Bank Address]....., all your rights under this guarantee shall stand forfeited and we shall be released and discharged from all liabilities under this guarantee whether or not this document shall have been returned to us.</u>	Provisions of Bidding documents shall prevail.
146.	Section-VII, Book 3 of 3 (Part 1)	Form-6 & Form- 7(i)	-	6.Performance Security Form; & 7(i).Bank Guarantee Form for Down Payment (Supply-FOB/Ex-Works)	Pursuant to SCC Clause Nos. 7.0 & 8.0, we request Employer to insert necessary provision(s) in the Bank Guarantee Formats regarding reduction of value of Bank Guarantee(s) issued towards Advance Payment & Performance Security.	Provisions of Bidding documents shall prevail.

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147.	Section-VII, Book 3 of 3 (Part 1)	Form-2, Form-6, Form-7(i) & Form-14	-	2. Bid Security; 6.Performance Security Form; 7(i).Bank Guarantee Form for Down Payment (Supply-FOB/Ex-Works); & 14. PROFORMA FOR BANK GUARANTEE TO BE FURNISHED BY THE EXECUTANT OF DEED OF JOINT UNDERTAKING OTHER THAN CONTRACTOR (For Steam Turbine Generator Sets)	We request Employer to insert following provision in the Bank Guarantee Formats: <u>This Guarantee shall be governed by the laws of India.</u>	Provisions of Bidding documents shall prevail.
148.	Section-VII, Book 3 of 3 (Part 1)	Form-11a, Form-11b & Form-17	-	11a. FORM OF INDEMNITY-CUM UNDERTAKING AGREEMENT FOR THE EQUIPMENTS HANDED OVER BY THE EMPLOYER FOR PERFORMANCE OF CONTRACT (Entire Equipment Consignment in one lot); 11b. FORM OF INDEMNITY-CUM UNDERTAKING AGREEMENT FOR THE EQUIPMENTS HANDED OVER IN INSTALMENTS BY THE EMPLOYER FOR PERFORMANCE OF CONTRACT; & 17. FORM OF INDEMNITY-CUM UNDERTAKING AGREEMENT WITH REGARD TO REMOVAL/DISPOSAL OF SCRAP/SURPLUS MATERIAL	We request Employer to insert following provision in the said forms for Indemnity-cum-Undertaking Agreement (i.e. Form-11a, Form-11b & Form-17): <u>This Indemnity cum Undertaking Agreement shall be governed by the laws of India.</u>	Provisions of Bidding documents shall prevail.

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149.	Section-VII, Book 3 of 3 (Part 1)	Form- 11b	-	11b. FORM OF INDEMNITY-CUM UNDERTAKING AGREEMENT FOR THE EQUIPMENTS HANDED OVER IN INSTALMENTS BY THE EMPLOYER FOR PERFORMANCE OF CONTRACT 5. That this Indemnity-cum-Undertaking Agreement is irrevocable. If at any time any loss or damage occurs to the Equipments or the same or any part thereof is mis-utilised in any manner whatsoever, then the 'Contractor' hereby agrees that the decision of the Project Manager of the 'Employer' as to assessment of loss or damage to the Equipments shall be final and binding on the 'Contractor'.	We request Employer to modify the provision as follows: That this Indemnity-cum-Undertaking Agreement is irrevocable. If at any time any loss or damage occurs to the Equipments or the same or any part thereof is mis-utilised by the Contractor in any manner whatsoever, then the 'Contractor' hereby agrees that the decision of the Project Manager of the 'Employer' as to assessment of loss or damage to the Equipments shall be final and binding on the 'Contractor'.	Provisions of Bidding documents shall prevail.
150.	Section-VI, Part-A (FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES)	1.01.02	8/20	Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price.	We request Employer to keep the cap of Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee at ten percent (10%) of the Contract Price.	Bidder to comply specification requirement.
151.	General	-	-	Aggregate LD	In line with standard industry practice and as per provisions available in other Central/State Utility Tenders, we request Employer to introduce a provision specifying the cap of Contractor's aggregate liability to pay liquidated damages for delay in Completion of	Provisions of Bidding documents shall prevail.

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					Facilities plus failure to attain the Functional Guarantees at fifteen percent (15%) of the Contract Price.	
152.	General	-	-	General	We request Employer that upon termination due to Force Majeure (GCC Clause-37) and/or Unforeseen Conditions (GCC Clause-35) and/or War Risks (GCC Clause-38), the reasonable cost compensation should be provided to the Contractor including cost towards work in progress, procured materials, storage and maintenance, in addition to the payments made to the Contractor in accordance with the Contract.	Provisions of Bidding documents shall prevail.

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153.	Section-III, BDS			Item no. 9.0	As per tender and as clarified during the pre-bid meeting held on 26.09.2018, the Project Schedule till Completion of Facilities from the date of Notification of Award shall be 44 & 50 months for Unit-1 and Unit-2 respectively. Please note the above-mentioned Project Schedule is very stringent for execution of such STG Package. In line with practice followed by other Central/State Utilities, we request you to kindly modify the project schedule to 48 & 54 months from the date of Notification of Award till Completion of Facilities. We shall be grateful, if THDC considers our above request and suitably modifies the Project Schedule.	The timelines given is based on the overall completion schedule of the Project. The work schedule as per provision of Bids, is to be adhered to by the bidders.
154.	General	-	-	General	In view of split package tendering, the execution of STG Package shall be dependent on availability of various inputs and interfaces related to the other packages of the project, for achieving timely completion of the contract. In case of any default by others in providing the requisite inputs/interfaces, the performance of contract shall be	Provisions of Bidding documents shall prevail.

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					impeded, leading to project delays and additional costs to the Contractor due to extended stay. Therefore, in such cases where the performance of Contractor is delayed due to reasons not attributable to him, we request Employer to declare deemed Completion of Facilities including deemed Completion of Guarantee Tests and release the associated payment stipulated under Sl. Nos. A1(VI), B1{VI), E{IV), F(V) & G(VI) under Appendix-1 to Form of Contract Agreement (Terms and Procedures of Payment) against submission of Bank Guarantee of equivalent amount by the Contractor. We shall be grateful, if THDC considers our above request and introduces provision(s) of deemed Completion of Facilities and deemed Completion of Guarantee Tests.	

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S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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1.	I	III-BDS Section VII Book 3 of 3 Part-1 Appendix-4	9.1	20 of 31 1 of 8	The Master Network shall conform to the following schedule dates for the key milestones of the Unit.	Bidder's liability to maintain Time for Completion of Facilities from the date of Notification of Award shall be 46 (forty-six) months for the Unit #1 and 52 (fifty-two) months for unit #2. The bidder may be allowed to modify the intermediate milestone dates as per its experience which would be discussed in detail during finalization of L1 network after award of contract.	The milestones indicated in work schedule are based on the experience gathered from various projects being executed by our Consultant. However, any minor changes in intermediate milestones may be discussed at L2 level, but, the same to be properly justified by the contractor and agreed to by the Employer.
2.	I	IV - GCC	7.2	9 of 57	Subject Matter of Contract The Contractor shall, unless specifically excluded in the Contract ----- materials were expressly mentioned in the Contract.	Subject Matter of Contract The Specifications are very extensive as such any change during Contract stage shall be at an additional cost. Please confirm.	Provisions of Bidding documents shall prevail. Bidder may also refer GCC Clause 39 (Change in the Facilities).
3.	I	IV -GCC	7.3.1.3	10 of 57	The Contractor will provide the EMPLOYER with the manufacturing drawings, catalogues, assembly drawings and any other document required by the EMPLOYER so as to enable the EMPLOYER to identify the recommended spares. Such details will be furnished to the EMPLOYER as soon as they are prepared but in any case not later	Employer may kindly modify the clause as below: The Contractor will provide the EMPLOYER with the ~~manufacturing~~ drawings, catalogues, assembly drawings and any other document required by the EMPLOYER so as to enable the EMPLOYER to	Provisions of Bidding documents shall prevail. Bidder to note that all supporting documents as required for identification of spares under GCC clause 7.3.1.3 shall be required to be submitted. However, in case the purpose of this

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S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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					than six months prior to commencement of manufacture of the corresponding main equipment.	identify the recommended spares. Such details will be furnished to the EMPLOYER as soon as they are prepared but in any case not later than six months prior to commencement of manufacture of the corresponding main equipment.	clause is not met with the documents furnished, Contractor shall be required to furnish manufacturing drawings.
4.	I	IV –GCC SCC	13.2.2 7.0	16 of 57 4 of 31	The security shall in the Form of an unconditional Bank Guarantees.....security is allowed.	We request Employer to kindly add clause as below: After every quarter Contractor will request the Employer for the reduction of BG. Employer shall ensure to communicate to the Contractor at the end of every quarter, the reduction to be effected in the bank guarantee corresponding to the advance adjusted. In case such advice is not received within 7 days from Contractors request, the cost of maintaining the bank guarantee shall be to Employers account.	Provisions of Bidding documents shall prevail.
5.	I	IV -GCC	15.1	19 of 57	Intellectual Property The copyright in all drawings, documents and other materials containing data and information furnished to the EMPLOYER by the Contractor herein shall remain vested in the Contractor or, if they	We request Employer to kindly modify clause as below: <u>The copyright–All intellectual property rights (including, patents, design, copyright, know-how)</u> in all drawings, documents and other materials	Provisions of Bidding documents shall prevail.

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S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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					are furnished to the EMPLOYER directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party. The EMPLOYER shall however be free to reproduce all drawings, documents and other material furnished to the EMPLOYER for the purpose of the contract including, if required, for operation and maintenance of the facilities.	containing data and information furnished to the EMPLOYER by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the EMPLOYER directly or through the Contractor by any third party, including suppliers of materials, the <u>intellectual property rights (including, patents, design, copyright, know-how)</u> in such materials shall remain vested in such third party. The EMPLOYER shall however be free to reproduce all drawings, documents and other material furnished to the EMPLOYER for the purpose of the contract including, if required, for operation and maintenance of the facilities.	
6.	I	IV -GCC	20.3.2	24 of 57	Within twenty one (21) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in	Please add following at the end of the para 20.3.2 <u>However, this would be in line with the Engineering Coordination procedure finalized in case of award.</u> Please Confirm.	Provisions of Bidding documents shall prevail.

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S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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					writing of its disapproval thereof and the reasons therefore and the modifications that the Project Manager proposes.		
7.	I	IV -GCC	27.8	36 of 57	Defect Liability If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons. Upon correction of the defects in the Facilities or any part thereof by repair/ replacement, such repair/replacement shall have the Defect Liability Period extended by a period of twelve (12) month from the time such replacement/ repair of the Facilities or any part thereof.	We request Employer to add the sub-clause at the end of the clause. Notwithstanding the above, in no event shall the Defect Liability of any part or component be extended by more than twenty-four (24) months from the date of Completion of Facilities or Operational acceptance, whichever occurs first. (Sunset Clause).	Provisions of Bidding documents shall prevail.
8.	I	IV - GCC	37.3	45 of 57	Force Majeure The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure	We request Employer to modify the clause as below: The party who has given such notice shall be excused from the performance ----- GCC Clause 40 (Extension of Time	Provisions of Bidding documents shall prevail.

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S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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					continues and to the extent that such party's performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40 (Extension of Time for Completion).	for Completion). <u>Contractor shall be reimbursed any additional cost incurred by reason of such Force Majeure.</u>	
9.	I	IV - GCC	40.1	50 of 57	Extension of Time for Completion New addition (g)	We request Employer to introduce SI. No. (g) as below: (g) Delay caused for any reason not attributable to the Contractor	Provisions of Bidding documents shall prevail.
10.	I	IV - GCC	40.1	50 of 57	Extension of Time for Completion by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.	We request Employer to insert the following line at the end of this clause: The price implications, if any, due to extension of time for Completion shall be mutually discussed and agreed upon between the parties.	Provisions of Bidding documents shall prevail.
11.	I	IV - GCC	41	50 of 57	Suspension The EMPLOYER/ Project Manager may, by notice to the Contractor, order the Contractor ----- --- as termination of the Contract under GCC Sub-Clause 42.1 (Termination for EMPLOYER's Convenience).	Please insert a new sub-clause as given below: Clause no. 41.5: Suspension shall not prevent the Employer from fulfilling its obligation of making payments to the Contractor for the works already executed / material dispatched.	Provisions of Bidding documents shall prevail.

Clarification No. 04 to Bidding Document (Commercial Portion)

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						Please confirm.	
12.	I	IV-GCC	43.1	57 of 57	Assignment:	Kindly add the clause as below: Assignment by Employer: The Employer shall not, without the express prior written consent of the contractor, assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or there under.	Provisions of Bidding documents shall prevail.
13.	I	VII Book 3 of 3 (Part 1) Appendix-1	I (i)	11 of 29	Indian custom Duties.....and the same shall be reimbursed to the Contractor on production of satisfactory evidence of having paid the custom duty amount to the concerned authorities.	We request Employer to modify the clause as below: Indian custom.....and the same shall be reimbursed to the Contractor/ Sub-Contractor on production of satisfactory evidence of having paid the custom duty amount to the concerned authorities	Provisions of Bidding documents shall prevail.
14.	I	VII Book 3 of 3 (Part 1) Appendix-1	I (iii)	11 of 29	Schedule - 7: Payment Terms for Taxes & Duties 100% of applicable Taxes and Duties (other than the custom duty payable as in para (i) above) which are payable by the Employer under the Contract shall be paid/reimbursed to the Contractor or	Schedule - 7: Payment Terms for Taxes & Duties 100% of applicable Taxes and Duties (other than the custom duty payable as in para (i) above) which are payable by the Employer under the Contract shall be	Provisions of Bidding documents shall prevail.

Clarification No. 04 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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					Assignee of foreign Contractor (if applicable) upon receipt of equipment/ spares/ services and on production of satisfactory documentary evidence by the Contractor/Assignee, as applicable. However, GST as applicable on Down payment shall be paid to the Contractor along with the Down payment sanctioned. The GST paid along with Down payment shall be adjusted prorata against the tax due upon supply of goods/services, based on the value of the respective goods/services.	paid/reimbursed to the Contractor/ Sub-Contractor or Assignee of foreign Contractor (if applicable) upon dispatch ~~receipt~~ of equipment/ spares/ services and on production of satisfactory documentary evidence by the Contractor/Assignee, as applicable. However, GST as applicable on Down payment shall be paid to the Contractor along with the Down payment sanctioned. ~~The GST paid along with Down payment shall be adjusted prorata against the tax due upon supply of goods/services, based on the value of the respective goods/services.~~	
15.	I	VII Book 3 of 3 (Part 1) Appendix x-1	4.1	14 of 29	Due Dates for Payment The Down payment amount shall be payable after fulfilment of all the conditions laid down in the Terms of Payment (Appendix 1 to the Contract Agreement) and receipt of the Contractor's invoice along with all necessary supporting documents	Due Dates for Payment The Down payment amount shall be payable within 7 days of fulfilment of all the conditions laid down in the Terms of Payment (Appendix 1 to the Contract Agreement) and receipt of the Contractor's	Provisions of Bidding documents shall prevail.

Clarification No. 04 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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					for such Down payment. Employer will make progressive payment as and when the payment is due as per the Terms of Payment set forth in Appendix 1 to the Contract Agreement. Progressive payment other than that under the Letter of Credit will become due and payable by the Project Manager within fifteen (15) days from the date of receipt of Contractor's bill/invoice/debit note by the Employer, provided the documents submitted are complete in all respects.	invoice along with all necessary supporting documents for such Down payment. Employer will make progressive payment as and when the payment is due as per the Terms of Payment set forth in Appendix 1 to the Contract Agreement. Progressive payment other than that under the Letter of Credit will become due and payable by the Project Manager within Seven(7) fifteen(15) days from the date of receipt of Contractor's bill/invoice/debit note by the Employer, provided the documents submitted are complete in all respects.	
16.	I	VII Book 3 of 3 (Part 1) V-SCC	Appendix -1 5.3 60	15 of 29 30 of 31	For Payment related to Erection/Civil/Site Fabricated Structural Works: A Single designated ESCROW.....15 days of the placement of award.	Considering that there is Qualification requirement in the tender for financial soundness of the bidder, such stringent method like Escrow account seems inappropriate. There would be a possibility of negative cash flow requirements at various times during the tenure of the project especially during the initial phase of the project considering	Provisions of Bidding documents shall prevail.

Clarification No. 04 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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						that there is NIL advance. With such Escrow account provisions, we will not be able to manage negative cash flow requirements of the project. The current mechanism of Escrow account proposed by THDCIL would be hindrance in smooth execution of the project.	
17.	I	VII Book 3 of 3 (Part 1)	Appendix -2 vii)	3 of 14	In case of shipments/despaches which are delayed beyond the schedule date of shipment/despatch for reasons attributable to the Contractor the price adjustment provision shall not be applicable for the period of time between the schedule date of shipment/despatch and the actual date of shipment/despatch. For this purpose, the schedule date of shipment/despatch shall be as as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.	We request the employer to modify the clause as below: In case of shipments/despaches which are delayed beyond the schedule date of shipment/despatch for reasons attributable to the Contractor the price adjustment provision shall not be applicable for the period of time between the schedule date of shipment/despatch and the actual date of shipment/despatch. For this purpose, the schedule date of shipment/despatch shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement. <u>In case of</u>	Provisions of Bidding documents shall prevail.

Clarification No. 04 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer's Reply
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						<u>shipments/despatches which are delayed beyond the schedule date of shipment/despatch for reasons not attributable to the Contractor, the price adjustment provision (based on actual date of despatch) shall be applicable for the period of time between the schedule date of shipment/despatch and the actual date of shipment/despatch.</u>	
18.	I	V-SCC	6.3.4	28 of 31	In case the Indian Contractor is a Central Government Department/..... issued by Government of India, Ministry of Heavy Industries and Public Enterprises, Department of Public Enterprises and its further modifications and amendments.	As AMRCD dispute Resolution is only applicable for BHEL as a Central PSU, please add the following at the starting of Paragraph: "Not withstanding anything contained herein" in case the Indian Contractor is a Central Government Department / issued by Government of India, Ministry of Heavy Industries and Public Enterprises, Department	Provisions of Bidding documents are clear and shall prevail.

Clarification No. 04 to Bidding Document (Commercial Portion)

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						of Public Enterprises and its further modifications and amendments.	
19.					General	At some places of Technical specification (Section VI Part-A & Part-B), mostly in Control and instrumentation portion, it is observed that specification is not readable/ the fonts are not recognizable. THDC is requested to provide readable tender specification i.e. PART-A & PART-B.	Specification is legible. Bidder may recheck the same.

Clarification No. 5 to Bidding Document (Qualifying Requirements) Dated: 08.03.19

Sl. No.	Section	Clause Ref.	Clarification sought by parties	Reply by Employer
1.	Section-I (IFB)/Section-III (BDS)	Qualifying Requirements Route 1-5 (Clause 1.1.0- Clause 1.5.0)	As per revised CEA Advisory Bidders participating through any of the five routes (i to v) shall NOT be required to furnish a Deed of Joint Undertaking (DJU) in case they meet the following criteria (specified under Note 2 in CEA Revised Advisory): <i>“8 nos supercritical boilers / or turbines manufactured/ supplied in India ...are in commercial operation (achieved COD) out of which 4 such boiler (or Turbine generator as the case may be) should be in commercial operation for at least one year and Performance Guarantee Tests should have been successfully completed in any Two Boiler (or Turbine generator as the case may be)”</i> As per THDC Khurja Specification <u>Criteria of 8/4/2 not indicated in Route 1-5 for exemption from DJU requirements</u> We therefore request you to kindly amend the Qualification Criteria specified in the Khurja tender to bring it exactly in line with the conditions laid down in the revised CEA Advisory by effecting following changes: Addition of Criteria 8/4/2 in each of Route 1-5 for exemption from DJU requirements.	Please refer Corrigendum No. 01 to IFB and Amendment No.10 to the Bidding Documents in this regard.
2.	Section-I (IFB)/Section-III (BDS)	Qualifying Requirements Route 6	As per revised CEA Advisory Introduction of Route No vi) with following eligibility: <i>“An Indian Manufacturing Company which is a ‘qualified’ Supercritical Boiler Manufacturer (or</i>	Please refer Corrigendum No. 01 to IFB and Amendment No.10 to the Bidding Documents in this regard.

Package: Turbine Generator And Associated Packages

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

Doc. No: THDC/RKSH/CC-9915-371-CLRF.05

Clarification No. 5 to Bidding Document (Qualifying Requirements) Dated: 08.03.19

Sl. No.	Section	Clause Ref.	Clarification sought by parties	Reply by Employer
		(Clause 1.6.1)	Supercritical Turbine manufacturer, as the case may be) and meets the criteria specified in Note 2. “ (Note 2 : as already specified above) As per THDC Khurja Specification Route No 6 introduced as per revised CEA Advisory <u>but with following additional requirement:</u> “.... In case the Indian Subsidiary Company/JV Company/Indian manufacturing company has manufactured/supplied supercritical Steam Generator(s) for any NTPC Project(s)/ station(s), then, out of the above two (2) such successfully PG tested Steam Generators, the PG test of at least one (1) such supercritical Steam Generator should have been successfully completed and accepted in the reference NTPC Project(s)/ station(s) prior to the date of techno-commercial bid opening.” We therefore request you to kindly amend the Qualification Criteria specified in the Khurja tender to bring it exactly in line with the conditions laid down in the revised CEA Advisory by effecting following changes: Deletion of requirement of PG Test in NTPC set in Route 6.	
3.	Section-I (IFB)/Section-III	Qualifying Requirements Route 6	As per revised CEA Advisory <u>No requirement of technology support agreement from collaborator/ technology provider is stipulated.</u>	Please refer Corrigendum No. 01 to IFB and Amendment No.10 to the Bidding Documents in this regard.

Clarification No. 5 to Bidding Document (Qualifying Requirements) Dated: 08.03.19

Sl. No.	Section	Clause Ref.	Clarification sought by parties	Reply by Employer
	(BDS)	(Clause 1.6.1)	As per THDC Khurja Specification <u>Additional requirement stipulated</u> as follows: <i>"Technology support agreement between the bidder and the collaborator/licensor/technology provider for successful performance of the Steam Generator and auxiliaries valid for a period of 07 (seven) years or up to the end of defect liability period of the contract whichever is later, as per the format enclosed in the bidding document, shall be submitted along with the techno commercial bid."</i> We therefore request you to kindly amend the Qualification Criteria specified in the Khurja tender to bring it exactly in line with the conditions laid down in the revised CEA Advisory by effecting following changes: Deletion of requirement of Technology sharing requirement in Route 6.	
4.	Section-I (IFB)	Qualifying Requirements Route 5 (Clause 1.5.0)	This refers to Central Electricity Authority's (CEA) revised advisory for sourcing of supercritical units from indigenous manufacturers vide its Letter No. CEA/TE& TD-TT /2017 /D-12/94-14 7 dated 27-January-2017. The revised advisory stipulates that the bidders shall not be required to furnish Deed of Joint undertaking(s) [DJU(s)] in case they meet the following criteria: "Eight (8) Nos. supercritical boilers (or turbine generators as the case may be) manufactured/supplied in India by the Indian	Please refer Corrigendum No. 01 to IFB and Amendment No.10 to the Bidding Documents in this regard.

Clarification No. 5 to Bidding Document (Qualifying Requirements) Dated: 08.03.19

Sl. No.	Section	Clause Ref.	Clarification sought by parties	Reply by Employer
			subsidiary/JV company/Indian manufacturing company are in commercial operation (achieved COD) out of which four (4) such boilers (or turbine generators as the case may be) should be in commercial operation for at least one year and Performance Guarantee Test should have been successfully completed in any two boilers (or turbine generators as the case may be)." In view of the aforementioned guidelines, we note that THDC has suitably introduced in the subject tender a new Qualifying Route i.e. Route-6 vide Clause No. 1.6.0 of Invitation for Bids (IFB), wherein the bidders qualifying under such route can avail the benefit of revised CEA advisory. However, the above benefit is not available to the bidders qualifying through Route-5. In view of the above and in order to provide a fair and equal opportunity to bidders participating through Route-5 w.r.t the revised advisory as mentioned above, we request THDC to modify the requirements stipulated under Route-5.	

Package: Turbine Generator And Associated Packages

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

Doc. No: THDC/RKSH/CC-9915-371-CLRF.05

Clarification No. 5 to Bidding Document (Qualifying Requirements) Dated: 08.03.19

Sl. No	Specification Reference				Specification	Requested Clarification	Employer's Reply
	Volume	Sectio	Clause No	page			
5	1	NIT	Note 1 to Clause 3.0.0	17 of 18	Note to clause 3.0.0 (1) Bidders who have already given commitments for PMP and submitted bank guarantees for security for default against specified PMP for steam Turbine Generators to any Central / State sector power generating Company for supercritical projects shall not be required to furnish further bank guarantees for security for default against specified PMP.	Bidder request to modify the below wordings in Note 1 to Clause 3.0.0 of NIT, to include release of bank guarantee for Security for default against specified PMP for Steam Turbine Generators: (1) Bidders who have already given commitments for PMP and submitted bank guarantees for security for default against specified PMP for steam Turbine Generators to any Central / State sector power generating Company for supercritical projects/ such bank guarantees for security for default against specified PMP for steam Turbine Generators is already released by any central / state sector power generating company shall not be required to furnish further bank guarantees for security for default against specified PMP. Bidder request to accordingly modify the attachment 18 and other relevant clauses of specification.	Please refer Corrigendum No. 01 to IFB and Amendment No.10 to the Bidding Documents in this regard.
6	1	NIT	Note 2 to Clause 3.0.0	17 of 18	(2) In case the Indian Subsidiary Company/JV Company/Indian manufacturing company have already completed PMP, for supercritical steam turbine then such Indian Subsidiary Company/JV Company/Indian manufacturing company need not submit the undertakings/documents for PMP again. However, certificate in support of completion of such PMP duly issued by the competent authority shall be submitted along with the techno-commercial bid.	of NIT, to include release of bank guarantee for Security for default against specified PMP for Steam Turbine Generators: (2) In case the Indian Subsidiary Company/JV Company/Indian manufacturing company have already completed PMP, for supercritical steam turbine then such Indian Subsidiary Company/JV Company/Indian manufacturing company need not submit the undertakings/documents for PMP again. However, certificate in support of completion of such PMP / Bank Guarantee release letter duly issued by the competent authority/ by any Central / state power generating company shall be submitted along with the techno-commercial bid Bidder request to accordingly modify the attachment 18 and other relevant clauses of specification.	Please refer Corrigendum No. 01 to IFB and Amendment No.10 to the Bidding Documents in this regard.

Package: Turbine Generator And Associated Packages

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

Doc. No: THDC/RKSH/CC-9915-371-CLRF.05

Clarification No. 6 to Bidding Document dated : 15.03.19

Sl. No.	Section/Part/Chapter/Volume	Clause Ref.	Page No.	Bidding Document Clause	Clarification sought by parties	Reply by Employer
1.	Section VI- Part B, SUB-SECTION-D-01 CIVIL WORKS	7.00.00	39 of 142	FOUNDATION SYSTEM AND GEOTECHNICAL DATA	In order to assess the soil conditions and accordingly consider in our bid, we would like to conduct preliminary soil investigation test at few locations within the proposed plant area. We request your consent for carrying out the aforesaid activity. Also please advise us the contact details of site representative, who can facilitate us for the said work. We had to carry out Geotech investigation activities in the STG area for subject project. Request to accord your approval as soon as possible to enable us to carry out necessary activities	Owner has carried out preliminary Geo-technical investigation in the proposed area (Please refer Cl.7.01.00 of Technical Requirements - Section VI- Part B, Sub-Section-D-01). Bidders shall consider the same for submission of their bids. Further, please also refer the provision of Cl.7.01.01(Technical Requirements - Section VI- Part B, Sub-Section-D-01) and Cl.7.01.02 (Technical Requirements - Section VI- Part B, Sub-Section-D-01) in this regard.
2.	Section-III, BDS	Item No. 19.0	28/31	Delay in signing of contract agreement In case delay in signing of contract agreement attributable to the contractor is caused due to non-submission of performance security within the stipulated time, a penalty shall be deducted from the RA bill (s) of the contractor as per the slab given below:.....	The successful bidder/Contractor would put in his best efforts to adhere to the timelines specified in tender for signing of Contract Agreement and submission of Performance Security. Such provision is not available in any other Central/State Utility Tenders. We, therefore, request Employer to delete this clause.	The provision of the tender documents remains unchanged.
3.	General	----	----	-----	Bidder request to arrange a training session on bid submission procedure on CPP portal.	Please refer Clarification No.2 dated 12.10.2018. Accordingly training/ hand-on session has already been conducted on 22-10-2018 at THDCIL's NCR office Ghaziabad. It was attended by the representatives of prospective bidders who choose to be present there.

Package: Turbine Generator And Associated Packages	CLARIFICATION NO. THDC/RKSH/CC-9915-371-CLRF-06	Page 1 of 1
Project: Khurja Super Thermal Power Project, (2 X 660 MW)		
Doc. No: THDC/RKSH/CC-9915-371		

Sl. No.	Specification Reference				Specification / Customer	Requested Clarification	THDC Response TG Clarification No. 4 Part 1 of 3	Bidders queries on THDC Clarification No. 4 Part 1 of 3	Employer's Reply
	Volume	Section	Clause No	Page					
1	III	BDS Item No. 9.0	ITB Cl. Ref. No. 39.0	20 of 31	Time for Completion of Facilities from the date of Notification of Award shall be 46 & 52 months for Unit 1 & Unit 2 respectively	Bidder understand that their is an typographical error in different places in bid specification and we request to kindly confirm that Completion of Facilities is 46 months for Unit 1 with unit gap of 6 months.	Completion of Facilities is 44 months for Unit1 with a phase gap of 6months for Unit-II. Please refer Amendment No.5 to the Bidding Documents in this regard.	Previous Turbine Island projects including the projects of NTPC for the Turbine island had COF 46months for unit 1 with unit gap of 6 months for subsequent unit. PG test was excluded in COF period and the same was conducted beyond COF within three months.	Please refer Amendment No. 11 to to the Bidding Documents in this regard.
2	III	BDS Item No. 9.0	ITB Cl. Ref. No. 39.0	21 of 31	1.0 Milestone Schedule for Steam Turbine & Auxiliaries: Table Sl. No. 24 Completion of facilities : 44 Months				
3	V	SCC No. 1	Reference GCC Cl. 1	2 of 31	Time for Completion: "Completion of the Facilities" for Unit-1 & Common System for the project shall be attained within 46 months from the date of Notification of Award. There will be a phase gap of 6 months in completion of facilities for subsequent Units.				
4	V	SCC No. 6	Reference GCC Cl. 8.2	4 of 31	Time for Completion: "Completion of the Facilities" for Unit-1 & Common System for the project shall be attained within 46 months from the date of Notification of Award. There will be a phase gap of 6 months in completion of facilities for subsequent Units.				
5	VII (Book 1 of 3)	Attachm ent 14	1.0	1-2 of 6	Major Activity / Milestone Chart 1.0 Milestone Schedule for Steam Turbine & Auxiliaries: Table Sl. No. 24 Completion of facilities : 46 Months				
6	VII (Book 3 of 3, Part 1)	Appendix 4	1.0	2 of 8	Major Activity / Milestone Chart 1.0 Milestone Schedule for Steam Turbine & Auxiliaries: Table .. Sl. No. 24 Completion of facilities : 44 months				
7	III	BDS	4.0	23 of 31	The network shall be prepared and submitted in MS Project format showing all inter activity relationships.....	Bidder requests to Incorporate Primavera software also and amend the clause as : The network shall be prepared and submitted in MS Project / Primavera format showing all inter activity relationships.....			Please refer Amendment No. 11 to the Bidding Documents in this regard.

Sl. No.	Specification Reference				Bidder's queries	Employer's Reply
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8	VII (Book 3 of 3, Part 2)	Form of DJU	Form 13C2	3 of 10	Wordings of Revised Form 13 C2 (Rev. 01) are as below: 3. We, the Qualified Steam Turbine Generator Manufacturer and the Qualified Generator Manufacturer do further undertake... Bidder request to kindly confirm that the same should be read as below, in line with the clarification, and request to issue the amendment in DJU. "3. We, the Qualified Steam Turbine Generator Manufacturer and the *Qualified Generator Manufacturer do further undertake... "	Please refer Amendment No. 7 to the Bidding Documents in this regard.
9	VII (Book 3 of 3, Part 2)	Form of DJU	Form 13C2	3 of 10	Wordings of Revised Form 13 C2 (Rev. 01) are as below: 4 That in consideration of the award of the Contract by the Employer to the Contractor, we the Qualified Steam Turbine Generator Manufacturer, Qualified Generator Manufacturer, OTHER PROMOTER Bidder request to kindly confirm that the same should be read as below, in line with the clarification, and request to issue the amendment in DJU. "4 That in consideration of the award of the Contract by the Employer to the Contractor, we the Qualified Steam Turbine Generator Manufacturer, *Qualified Generator Manufacturer, OTHER PROMOTER "	Please refer Amendment No. 7 to the Bidding Documents in this regard.

Clarification No. 07 to Bidding Document (Commercial Portion)

S/N	Section/Part/ Chapter/Volume	Clause No.	Page No.	Bidding Document Clause	Statement of Bidders Queries & Clarifications	Employer s Reply
10.	Section-II, ITB	14.0	20/38	The bid including all documents uploaded on the website http://eprocure.gov.in/eprocure/app shall be digitally certified using Class-III signature by a duly authorised representative of the Bidder to bind him to the contract. The authorization shall be indicated by written power of attorney as per ITB Clause 8.1.1 (b) & 8.2.1 (b) and shall be submitted in physical form prior to date & time for opening of bid.	Bidder shall upload all Bid documents in e-tender portal http://eprocure.gov.in/eprocure/app by using Class-III signature. Further, it is understood that each document need not be digitally signed before uploading. Kindly confirm.	It is to clarify that as per the procedure of uploading of documents on CPP Portal, the portal accepts the documents only after digitally signing the document by the Digital Signature Certificate (DSC) key at the time of submission. Bidders may also check it themselves at CPP Portal.
11.	Bid security form,Section VII Book 3 of 3,Part-1	NOTE:3	-	The BG should be on Non-Judicial stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where BG is executed, whichever is higher. The Stamp Paper/e-Stamp paper shall be purchased in the name of Bidder/Bank issuing the guarantee.	Confirm the value of stamp paper to be followed for bid security to be furnished with the offer.	The clause is self explanatory. The value of the requisite stamp paper is to be ensured by the respective bidders in line with the provisions of bid documents.

Package: Turbine Generator And Associated Packages

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

Doc. No: THDC/RKSH/CC-9915-371-CLRF.07

Sl. No.	Specification Reference				Specification / Customer	Requested Clarification	Employer's Reply
	Volume	Section	Clause No	page			
12	I	CORRIGENDUM NO.1 to IFB No.: 2018_THDC_378381	Clause 3.00 and Note to clause 3.0.0	15 of 16	(2) In case the Indian Subsidiary Company/JV Company/Indian manufacturing company have already completed PMP, for supercritical steam turbine then such Indian Subsidiary Company/JV Company/Indian manufacturing company need not submit the undertakings/documents for PMP again. However, certificate in support of completion of such PMP duly issued by the competent authority or proof of release of the bank guarantee by any Central / State power generating company shall be submitted along with the techno-commercial bid.	With the referred clauses bidder understand that: In support of completion of PMP, Bidder can submit proof of release of the bank guarantee and can mention that attachment 18 is not applicable in Attachment -3A7, hence bidder need not to submit the Attachment 18 and 19. Please confirm that bidders understanding is correct.	Provisions of the Bidding documents are clear in this regard.
13	VII	Book 1 of 3	ATTACHMENT-3A7	1 of 1	PROFORMA OF LETTER OF UNDERTAKING TO BE SUBMITTED BY THE BIDDER FOR PHASED MANUFACTURING PROGRAMME ALONGWITH THE BID IS ATTACHED AT ATTACHMENT-18 TO BID FORM (TECHNO-COMMERCIAL)		
14	VII	Book 1 of 3	ATTACHMENT-18 (Rev 01)	Complete Attachment	Complete Attachment		

Clarification No. 08 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer s Reply
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1.	I	VII Book 3 of 3 (Part 1) Appendix-1	A1. (I) cl. B1. (I)	1 of 29 4 of 29	Terms and procedures of payment for Schedule No.1 & 2: (a) Five percent (5%) of the Total FOB/Ex work Supply Price Component of Contract Price as Initial Down payment shall be paid as follows: (i) Acceptance of Notification of award and signing of the Contract Agreement. ----- ---- (vi) Submission of detailed PERT Network-----the Employer.	We request employer to modify first advance and terms of payment for Schedule No.1 & 2 as following Terms and procedures of payment: (a) First installment of 10% shall be paid on submission of: (i) Acceptance of Notification of award and signing of the Contract Agreement. ----- ----- (vi) Submission of detailed PERT Network-----the Employer. Kindly delink signing of the Contract Agreement and Submission of detailed PERT Network for release of first advance as these activities will take time. Kindly confirm.	Provisions of the Bidding documents shall prevail. Bidder may also refer Amendment No. 13 to Bidding documents.

Package: Turbine Generator And Associated Packages	
Project: Khurja Super Thermal Power Project, (2 X 660 MW)	
Doc. No: THDC/RKSH/CC-9915-371-CLRF.08	

Clarification No. 08 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer s Reply
	Vol. No.	Section No.	Clause No.	Page No.			
2.	I	VII Book 3 of 3 (Part 1) Appendix-1	A1. (VI) a,b cl. B1. (VI)	2 of 29 5 of 29	Terms and procedures of payment for Schedule No.1 & 2 (a) Ten Percent (10%) of FOB Supply Price Component of the contract price on Successful Completion of Initial Operation including all associated auxiliaries and ancillary works along with successful Completion of Guarantee Tests and issue of Completion Certificate by the Project Manager for Unit-I and common facilities. (b) Ten Percent (10%) of FOB Supply Price Component of the contract price on Successful Completion of Initial Operation including all associated auxiliaries and ancillary works along with successful Completion of Guarantee Tests and issue of Completion Certificate by the Project Manager for Unit-II.	Amount of 20% of FOB Supply Price on Successful Completion of Initial Operation including all associated auxiliaries and ancillary works along with successful Completion of Guarantee Tests is on very higher side comparison to industry practice. THDCIL is requested to review the same and change the same to 5% of FOB Supply Price (i.e 2.5% of FOB Supply Price on each Unit). (a) 2.5% of FOB Supply Price Component of the contract price on Successful Completion of Initial Operation including all associated auxiliaries and ancillary works along with successful Completion of Guarantee Tests and issue of Completion Certificate by	Please refer Amendment No. 13 to Bidding documents in this regard.

Package: Turbine Generator And Associated Packages	
Project: Khurja Super Thermal Power Project, (2 X 660 MW)	
Doc. No: THDC/RKSH/CC-9915-371-CLRF.08	

Clarification No. 08 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer s Reply
	Vol. No.	Section No.	Clause No.	Page No.			
						the Project Manager for Unit-I and common facilities. (b) 2.5% of FOB Supply Price Component of the contract price on Successful Completion of Initial Operation including all associated auxiliaries and ancillary works along with successful Completion of Guarantee Tests and issue of Completion Certificate by the Project Manager for Unit-II.	
3.	I	VII Book 3 of 3 (Part 1) Appendix-1	E (IA)	7 of 29	Terms and procedures of payment for Schedule No.4: Installation Services excluding Civil and Site Fabricated Structural Works Portion The Foreign Currency Portion as well as Local Currency Portion of the Total Installation Services Component of the Contract Price	Terms and procedures of payment for Schedule No.4: Installation Services excluding Civil and Site Fabricated Structural Works Portion We request Employer to provide interest free advance 10% for Installation Services Component.	Please refer Amendment No. 13 to Bidding documents in this regard.

Package: Turbine Generator And Associated Packages	
Project: Khurja Super Thermal Power Project, (2 X 660 MW)	
Doc. No: THDC/RKSH/CC-9915-371-CLRF.08	

Clarification No. 08 to Bidding Document (Commercial Portion)

S. No	Reference of Tender Specification				Specification Requirement	Statement of Clarifications	Employer s Reply
	Vol. No.	Section No.	Clause No.	Page No.			
					of Plant and Equipment (excluding Civil and Site Fabricated Structural Works Portion) shall be paid as under: (I)(A) DELETED (I)(B) DELETED	Kindly confirm.	
4.	I	VII Book 3 of 3 (Part 1) Appendix-1	F (IA)	8 of 29	Terms and procedures of payment for Schedule No.4: Civil Works The Civil Works Price Component of the Contract Price shall be paid as under: (I)(A) DELETED (I)(B) DELETED	Terms and procedures of payment for Schedule No.4: Civil Works We request Employer to provide interest free advance 10% for Civil Works. Kindly confirm.	Please refer Amendment No. 13 to Bidding documents in this regard.
5.	I	VII Book 3 of 3 (Part 1) Appendix-1	G (IA)	10 of 29	Terms and procedures of payment for Schedule No.4: Site Fabricated Structural Works The Site Fabricated Structural Works Price Component of the Contract Price shall be paid as under: (I)(a) DELETED (I)(b) DELETED	Terms and procedures of payment for Schedule No.4: Site Fabricated Structural Works We request Employer to provide interest free advance 10% for Site Fabricated Structural Works. Kindly confirm.	Please refer Amendment No. 13 to Bidding documents in this regard.

Package: Turbine Generator And Associated Packages	
Project: Khurja Super Thermal Power Project, (2 X 660 MW)	
Doc. No: THDC/RKSH/CC-9915-371-CLRF.08	

Sl. No.	Specification Reference				Specification	Requested Clarification	Employer s Reply
	Volume	Section	Clause No	page			
6	VII (Book 3 of 3, Part 1)	Appendix - 1	Schedule No. 1, A1 and Schedule No. 2, B1	1-6 of 29	A1.: For FOB Price Component of Plant and Equipment (excluding Mandatory Spares and Type Tests): B1: Ex-works Price Component of Plant and Equipment (excluding Mandatory Spares and Type Tests)	Proposed payment terms are creating huge negative cash flow, hence bidder requests to kindly amend the payment terms for Offshore / Onshore supply as below: Advance : 10% within 60 days of NOA +5% at 4 Months from NOA against BG of equivalent amount On dispatch : 65% Receipt of material at site : 10% Completion of facilities(COF) : 5% (2.5% against COF of Unit 1 and 2.5% against COF of Unit2) PG Test : 5% (2.5% against COF of Unit 1 and 2.5% against COF of Unit2)	Please refer Amendment No. 13 to the Bidding Documents in this regard.
7	VII (Book 3 of 3, Part 1)	Appendix - 1	Schedule No. 4	1-6 of 29	E. Schedule No. 4 : Installation Services excluding Civil and Site Fabricated Structural Works Portion.... F. Schedule No. 4 : Civil Works..... G. Schedule No. 4 : Site Fabricated Structural Works.....	Proposed payment terms are creating huge negative cash flow, hence bidder requests to kindly amend the payment terms for Schedule 4 items as below: Advance : 10% interest free advance. Progress payment : 80% (Prorata on quantum of work completed) Completion of facilities(COF) : 5% (2.5% against COF of Unit 1 and 2.5% against COF of Unit2) PG Test : 5% (2.5% against COF of Unit 1 and 2.5% against COF of Unit2)	Please refer Amendment No. 13 to the Bidding Documents in this regard.

Clarification No. 08 to Bidding Document (Commercial Portion)

S/ N	Section/Part/ Chapter/Volume	Clause No.	Page No.	Bidding Document Clause	Statement of Bidders Queries & Clarifications	Employer s Reply
8.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendi x-1 Sl. Nos. A1 & B1	1/29 to 6/29	TERMS AND PROCEDURES OF PAYMENT	We request Employer to modify the Terms of Payment for FOB/Ex-works Supply Portion as follows: 1. Advance – 15% (interest free) 2. Dispatch of Equipment – 60% 3. Receipt of Equipment – 15% 4. Completion of Facilities of U#1 – 2.5% 5. Completion of Facilities of U#2 – 2.5% 6. Completion of Guarantee Test of U#1- 2.5% 7. Completion of Guarantee Test of U#2- 2.5%	Please refer Amendment No. 13 to Bidding documents in this regard.
9.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendi x-1 Sl. Nos. E, F & G	7/29 to 10/29	TERMS AND PROCEDURES OF PAYMENT	We request Employer to modify the Terms of Payment for Installation Services, Civil Works and Site Fabricated Structural Works as follows: 1. Advance – 10% (interest free) 2. Pro rata Progressive Payment – 80% 3. Completion of Facilities of U#1 – 2.5% 4. Completion of Facilities of U#2 – 2.5% 5. Completion of Guarantee Test of U#1- 2.5%	Please refer Amendment No. 13 to Bidding documents in this regard.

Package: Turbine Generator And Associated Packages

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

Doc. No: THDC/RKSH/CC-9915-371-CLRF.08

Clarification No. 08 to Bidding Document (Commercial Portion)

S/ N	Section/Part/ Chapter/Volume	Clause No.	Page No.	Bidding Document Clause	Statement of Bidders Queries & Clarifications	Employer s Reply
					6. Completion of Guarantee Test of U#2- 2.5%	
10.	Section-VII, Book 3 of 3 (Part 1) (Form of Contract Agreement)	Appendix-1 Sl. No. C	7/29	TERMS AND PROCEDURES OF PAYMENT	In line with standard industry practice, we request Employer to modify the Terms of Payment for Mandatory & Recommended Spares as follows: 1. Dispatch to Site – 90% 2. Receipt at Site – 10%	Please refer Amendment No. 13 to Bidding documents in this regard.
11.	Section-VII (Book 3 of 3) (Part 1)	-	-	Appendix-1 (Terms And Procedures Of Payment) to Form No. 5 (Form of Contract Agreement)	1. As per tender, only 5% advance shall be provided on the FOB/Ex-works Supply Price Component (i.e. Supply Portion) of the Contract Price. Please note that Supply Portion constitutes almost 70% to 75% of the total Contract Price of such STG Package, wherein such a low amount of advance is not sufficient for executing project of such high value. We therefore request THDC to increase the amount of advance from 5% to 15% on Supply Portion. 2. As per tender, 20% payment (10% for each unit) of Supply Portion shall be retained till successful completion of Guarantee Tests. We strongly feel that retention of 20% payment is very high and will put the Contractor under financial stress.	1. Please refer Amendment No. 13 to Bidding documents in this regard. 2. Please refer Amendment No. 13 to Bidding documents in this regard.

Package: Turbine Generator And Associated Packages

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

Doc. No: THDC/RKSH/CC-9915-371-CLRF.08

Clarification No. 08 to Bidding Document (Commercial Portion)

S/ N	Section/Part/ Chapter/Volume	Clause No.	Page No.	Bidding Document Clause	Statement of Bidders Queries & Clarifications	Employer s Reply
					Thus, we request THDC to modify the retention payment as follows: • On Completion of Facilities: 2X2.5% • On Completion of Guarantee Tests & Operational Acceptance: 2X2.5%	
12.	Section-VII (Book 3 of 3) (Part 1)			Appendix-1 (Terms And Procedures Of Payment) to Form No. 5 (Form of Contract Agreement),	we would like to request you to improve the payment terms that facilitate a cash-neutral position for the contractor as proposed below: Supply Advance: 10% within 60 days of NOA +5% at 4 Months from NOA On dispatch: 65% Receipt of material at site: 10% Completion of facilities(COF): 10% (5% against COF of Unit 1 and 5% against COF of Unit2) Services Advance: 10% Progress payment: 80% (Prorata on quantum of work completed) Completion of facilities(COF): 10% (5% against COF of Unit 1 and 5% against COF of Unit2)	Please refer Amendment No. 13 to Bidding documents in this regard.

Package: Turbine Generator And Associated Packages	
Project: Khurja Super Thermal Power Project, (2 X 660 MW)	
Doc. No: THDC/RKSH/CC-9915-371-CLRF.08	

CLARIFICATION NO 09 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

Sl. No	SECTION N	SUB-SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION / CUSTOMER		REQUESTED CLARIFICATION	EMPLOYER REPLY
1	Section -VI / Part-A	Mandatory Spares	Group A/1	5 OF 59	Complete assembly of HPT blades (includes inner blade casing and bladed rotor including all internal in assembled condition and fitted in outer casing along with Breach Nuts (if applicable)	1 No	Bidder understands that bidder has to offer 1 no. complete assembly of HP Turbine instead of HPT blades. Customer to confirm.	The item description mentioned by the bidder is not correct and complete. Specification requirement are clear in this regard. Bidder to comply.
2	Section -VI / Part-A	Mandatory Spares	Group A/2	5 OF 59	Complete assembly of IPT blades (includes inner blade casing and bladed rotor including all internal in assembled condition along with full set of both ends of stationary gland seal segments(Finned)	1 No	Bidder understands that bidder has to offer 1 no. complete assembly of IP Turbine without Outer casing instead of IPT blades. Customer to confirm.	The item description mentioned by the bidder is not correct and complete. Specification requirement are clear in this regard. Bidder to comply.
3	Section -VI / Part-A	Mandatory Spares	Group A/8	6 OF 59	AC jacking oil pump complete assembly for Main Turbine along with complete coupling	1 No	Bidder understands that AC JOP with complete coupling is to be offered without motor. Customer to confirm.	Please refer amendment in this regard

CLARIFICATION NO 09 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)									
4	Section -VI / Part-A	Mandatory Spares	Group A/9	6 OF 59	DC jacking oil pump assembly for Main Turbine along with complete coupling	1 No	Bidder understands that DC JOP with complete coupling is to be offered without motor. Customer to confirm.		Please refer amendment in this regard
5	Section -VI / Part-A	Mandatory Spares	Group A/10	6 OF 59	EOP for lubricating system for Main Turbine along with complete coupling	1 Set	Bidder understands that EOP with complete coupling is to be offered without motor. Customer to confirm.		Specification requirement are clear in this regard. Motor is already specified in the referred item. Bidder to comply.
6	Section -VI / Part-A	Mandatory Spares	Mandatory Spares for LT Switch gears & LT Busducts	50 OF 59	LV SWITCHGEAR		In LV switchgear panel of Oil Purifier, the specified spares are installed in 1 no or 2 nos. Offering large quantity as specified is not recommended by Bidder to be kept as spares. Accordingly, Bidder will offer following quantity of these spares as per bidder recommendation :		Bidder understanding is not correct. Identified clause is for Mandatory spare requirements of LV switchgear and not for local control panel of oil purifier.
					Aux. Contact set of each type & rating	6 sets			
					Limit switches of each type & rating	10 Nos.			
					Fixed contact set of each type & rating	6 sets			
					Moving contact set of each type & rating	6 sets			
		1 No							
KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW)TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371							CLARIFICATION NO. THDC/RKSH/CC-9915-371-CLRF-09		PAGE 2 OF 4

CLARIFICATION NO 09 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

					<table><tr><td>Current transformer of each type & ratio</td><td>3 Nos</td></tr><tr><td>Power fuses (equally divided for all ratings)</td><td>100 Nos.</td></tr><tr><td>Thermal Bimetal relays (equally divided for all ratings)</td><td>30 Nos.</td></tr></table>	Current transformer of each type & ratio	3 Nos	Power fuses (equally divided for all ratings)	100 Nos.	Thermal Bimetal relays (equally divided for all ratings)	30 Nos.	<table><tr><td>1 No of each type</td></tr><tr><td>1 No of each type Customer to confirm.</td></tr></table>	1 No of each type	1 No of each type Customer to confirm.	
Current transformer of each type & ratio	3 Nos														
Power fuses (equally divided for all ratings)	100 Nos.														
Thermal Bimetal relays (equally divided for all ratings)	30 Nos.														
1 No of each type															
1 No of each type Customer to confirm.															
7	Section -VI / Part-A	Mandatory Spares	Mandatory spares for Rooftop solar PV	391	Inverter - 1 No of PCU(if applicable) and 1 No of string inverter of highest size of supplied capacity. PCU / String Inverter cooling fan, if applicable - 5% of total population Communication cards of PCU / String Inverter if applicable – 1 set Control card of PCU, if applicable-1 set IGBT bank of PCU, if applicable- 1 set	Spares of inverter cannot be supplied. However, a complete inverter shall be supplied as spare.	Bidder to comply with technical specifications								
8	Section -VI / Part-A	Mandatory Spares	Solar Rooftop	217	Scope of Work	1. Our scope is limited to evacuation till LT panel. The capacity of solar PV plant shall be fed to the LT panel, the transformers after which shall be capable of bearing the solar generated power. The transformers are not a part of our scope. 2. We may use existing earthing pits for earthing. 3. The roofs should have a load bearing	1.The entire scope of work comes under STG Bidder 2.It is left to the STG Bidder 3. The same has to be ensured by STG Bidder								

CLARIFICATION NO 09 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						capacity of 60 kg per m sq. 4. Connectivity may be ensured at customer's end for logging of data. 5. We assume that 625kW capacity is derived, considering shadow-free area only.	4.The same has to be ensured by STG Bidder 5.Bidders understanding is correct
9	Section -VI / Part-A	Mandatory Spares	Quality : Solar Roof Top		1. PCU 3. Array Junction Box/String Monitoring Box 4.DC Cable	In-process quality checks are not possible as these are bought-out items and are imported in India in complete stage only. However, visual inspection at site or inspection at warehouses of local/Indian vendors can be conducted. Also, we shall be providing relevant test certificates as per standard from our OEM vendors for these items. Further during PG Test all relevant operations viz. startup, stable operation, synchronization, shutdown, etc. shall be demonstrated at Site.	Bidder to comply with technical specifications

THDC INDIA LIMITED

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



Clarification No.10

dated 26th Mar'2019
to

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

CLARIFICATION NO. THDC/RKSH/CC-9915-371-CLRF-10

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

Clarification No. 10 to Bidding Document (Qualifying Requirements)

Sl. No.	Specification Reference	Description	Clarification sought by parties	Reply by Employer
1.	Cl. No. 3.0.0, Corrigendum No. 1 to IFB, dated 08.03.2019 Attachment No. 18 (Rev. 01), Amendment No. 10 dated 08.03.2019	Phased Manufacturing Program and Transfer of Technology. Letter of Undertaking for PMP.	As per Note (2) of 3.0.0 of Corrigendum No. 1 of IFB dated 08.03.2019, Attachment No 18 (Rev. 01), Amendment No. 10 dated 08.03.2019, Letter of Undertaking for Phase Manufacturing Program (equity participation, transfer of technology, land requirement etc.) is not applicable to us as we had already submitted the requisite PMP BGs against Mauda, Gadarwara and Suratgarh projects and these BGs have already been released (copy of proof of release of Suratgarh PMP BG is enclosed) Kindly confirm the above.	Provisions of the Bidding documents are clear in this regard.
2.	Section-III, BDS, Clause No. 4.0, Sub Clause No. 4.2, 2nd para, Page No. 19 of 31	Qualifying Requirements for Bidders.	Since NTPC is the consultant for the project, we request THDC to add the following clause at the end of second para: "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". This is in line with corresponding clause of NTPC tenders (copy of relevant clause enclosed). Alternatively, Owner may accept the extracts from reports available at CEA website (public domain portal) as support document of Commercial Operation (COD) & unit operation thereafter. Kindly confirm the above.	Bidder may refer Amendment No. 15 to Bidding documents in this regard.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

Sl. No	SECTION	SUB-SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION / CUSTOMER	REQUESTED CLARIFICATION	EMPLOYER REPLY
1	VI/B	A-3	1.01.03 e)	4 OF 92	wherever, auxiliary steam is being used for equipment under his scope of supply. Bidder to further note that when auxiliary steam is being tapped from auxiliary boiler, auxiliary steam will be available at temperature of 240 C. Bidder's query : Minimum Auxiliary steam temperature required for steam turbine is 300 deg C Owner's reply : Bidder to comply the specification requirement.	Bidder once again requests Owner to provide aux. steam for Main turbine gland sealing at min. 285 Deg. C as per OEM requirement.	Specification requirements are clear in this regard. Bidder to comply.
2	VI/B	D-01	5.07.02 Civil Works for Fire Detection & Protection System in Ground Floor/ Paving	24 OF 142	Each of the outdoor deluge valve and accessories shall be provided with housing comprising of Brick wall and RCC roof. <u>Bidder's Query:</u> Since, Hydrant and Spray system is not in bidder scope for this tender/package, hence, bidder understands that referred clause for deluge valve and accessories is not applicable for this tender/package. Owner to please confirm. <u>Owner's Clarification:</u> Bidder's understanding is correct that LP Dosing system is excluded from bidder's scope. Noted.	Owner's reply is not clear to us and we request Owner to relook in to our query which is as below:- Since Hydrant and Spray system is not in bidder's scope for this tender/package, hence, bidder understands that referred clause for deluge valve and accessories is not applicable. Please confirm Bidder's understanding.	Bidder is requested to refer tender drawing no. 9915-999-POM-A-046 issued as amendment regarding scope of work.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

3	VI/B	A-5	4.04.00 ,e)	5 of 24	The resin shall be suitable for the condensate temperature that may be achieved in all operating regimes of TG cycle. However, the anion resin shall be suitable for a temperature of 60°C.	We request owner to kindly revisit and confirm bidder's understanding as follows:- "As per the resin supplier recommendation, the Anion Resin will undergo a thermal degradation at high condensate temperature (above 60 Deg C) and will lose the half of its capacity and silica removable capacity is almost Zero. Hence for temperature beyond 60 C, the CPU bypass valve shall be open 100% to bypass the entire condensate water.	Minimum process design Temperature is specified. Since turbine and CPU both are in bidder's scope, bidder to decide & select condenser temperature suitably to meet design & system requirements of CPU system.
	CLARIFICATION NO. THDC/RKSH/CC-9915-371-CLRF-03		4.05.00 ,c)	6 OF 24	(c) Design temperature of service vessel and their internals/appurtenances shall take care of all operating regimes including HP-LP bypass operation and minimum 70°C. Process design temperature shall be based on all operating regimes of TG cycle and minimum 52°C. However, short term excursion of temperature upto 60°C is also expected.	Owner to please note that the condensate temperature will always be in 52 C to 60 C range.	
		40		15 OF 95	<u>Clarification S. NO. 40</u> As per the resin supplier recommendation, the Anion Resin... ...Request Owner to confirm acceptance. <u>Owner's response:</u> Insulation is not required. However, TE,TT,TI etc are envisaged in Tender drawing for temperature control & burn-out protection.	Request owner to confirm acceptance."	
4	VI/B	A-5	5.07.00	13 OF 24	This tank shall be provided with burn out protection, pressure relief valve, level transmitters/switches, temperature indicator etc. The heater shall be controlled by the temperature switches provided on the tank. The heaters shall be sized for heating the water from a temperature of 15 °C to 50 °C at the outlet.	Bidder requests owner to revisit the query and confirm bidder's understanding. "We understand the term burn-out protection is referred to tank insulation for personnel safety. Insulation is not required for hot water tank as the temperature of the water inside the tank will not exceed 50 C. Hence, the burn out protection is not considered for Hot water tank and associated pipe lines and valves.	Insulation is not required. However, TE,TT,TI etc are envisaged in Tender drawing for temperature control.
	CLARIFI		42	15 OF	<u>Clarification S. NO. 42</u> We understand the term burn-out... ...Request Owner's acceptance in this regard..		

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

	CATIO N NO. THDC/ RKSH/C C- 9915- 371- CLRF- 03			95	<u>Owner's response:</u> Specification is quite clear in this regard. In the referred clause, dissolved solids concentration are mentioned.	Request Owner's acceptance in this regard."	
5	CLARI FICAT ION NO. THDC/ RKSH/ CC- 9915- 371- CLRF- 03		47	18 OF 95	<u>Clarification S. NO. 47</u> Bidder understands that resin transfer piping from TG building to regeneration area and associated utility piping shall be laid on Owner's pipe rack/sleepers. No pipe rack/sleeper are envisaged in bidder's scope. Please confirm bidder's understanding. <u>Owner's response:</u> Scope of pipe rack/supporting structure are given in a separate drawing. Bidder to refer the same.	To give more clarity, bidder will consider following pipes in stretch-1 and stretch-6 pipe racks which shall be under SG scope:- i) Resin transfer line from TG building CPU vessels to CPU regeneration area ii) Resin transfer line from CPU regeneration area to TG building CPU vessels iii) Instrument air/service air connection (if dedicated connections are not provided by SG vendor near CPU regeneration area) iv) Service water connection (if dedicated connections are not provided by SG vendor near CPU regeneration area)	Bidder to note that space for these pipes shall be provided on stretch-1(SG scope) only. But bidder to make his own arrangement for laying down pipes from CPU to Stretch-1.
6	VI/B	A-4	4.01.00 , a)	7 of 20	Primary Water pumps:- Design flow of all TG Auxiliary coolers	Bidder has estimated design flow rate for ECW pump based on maximum heat load across connected coolers (working coolers only, no standby coolers). Owner is requested to confirm bidders	Maximum heat load through working coolers to be considered for arriving at the

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						understanding.	design flow in addition to the flow through such stand by coolers which are required to be kept open as per operation control philosophy.
7	VI/B VI/C	A-3 GTR	8.03.05 .01	48 OF 92 19 OF 89	(m) Preservation by nitrogen blanketing during shut down. Generator and Auxiliary System including Generator, complete hydrogen cooling, carbon dioxide and nitrogen gas systems as applicable,	In absence of clarity, Bidder understands that H2 and CO2 cylinders shall be provided by bidder. However, N2 cylinder will be under SG supplier scope which shall be common for Boiler and turbine. Owner is requested to check and confirm.	Nitrogen cylinders as per requirement for the scope covered under this package shall be under bidder's scope of supply. Bidder to further refer tender P&ID 'CENTRALISED NITROGEN FILLING SYSTEM', 9915-110-POM-A-015B, Part-E, Section VI also in this regard.
8	VI/E	Tender Drawings			Drawing no. 9915-999-POC-F-001 (REV. 1) titled "GENERAL LAYOUT PLAN"	As per AMENDMENT NO. THDC/RKSH/CC-9915-371-AMDT-04, sl. No. 164, GLP Rev. 01, Location of CPU regeneration building & plant air compressor is identified. Considering the scope of Supply of CPU regeneration facility (In TG scope) and Plant air compressor facility (In SG scope),	Bidder is requested to follow the location of facilities as per technical specification.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						bidder proposes to interchange the location of CPU and Plant air compressor building/facilities as it will result in optimization of layout between CPU & CPU Regeneration Area. Request owner to accept the same.	
9	VI/B	A-2	1.01.02 (c)	01 of 12	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.	Bidder proposes, 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 center line of double lane road and 12 meter with respect to center line of single lane road. Owner is requested to confirm the same, as this clause is updated in latest NTPC tenders (Lara & Singrauli).	Bidder to refer amendment in this regard.
10	VI/B	D-01	3.02.00 (g)	05 of 142	A panoramic bird's eye view of Overall plant shall be submitted in laminated A-1 Size hardcopy (Two Numbers) and soft copy in AutoCAD.	Under "Turbine Generator and Associated packages " scope is limited to turbine building and auxiliaries. Considering same Owner to please clarify the requirement of overall plant bird eye view. Please Confirm.	Bidder shall provide panoramic view of plant area which is in Bidder's scope of work

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

11	VI/B	A-2	1.02.00 (h) (4)	2 OF 12	For each transformer a pit shall be provided all around at a distance of 1.5 m (minimum) from transformer outer edge. A sump pit shall be provided for each pit. 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. Sump pit of individual transformer shall be connected to common oil retention pit of that unit.	Two different philosophies have been indicated in the referred clauses. Bidder understands that either of the philosophies may be adopted during detail design. Please confirm.	Query has been already replied to. Bidder is requested to refer Clarification no. 3.
			5.08.00	24 of 142	The oil soak pit, if provided, shall be filled with gravel of size 40mm. The volume of the soak pit shall be sufficient to store complete oil of the transformer/reactor along with 10 minutes of fire water considering only 40% of the volume as available voids between gravel filling. However, in case separate Oil-water Separation pit is provided for a group of transformers/reactors, oil soak pit of volume equivalent to one-third (1/3) the oil volume of each transformer/reactor shall be provided around respective transformer/reactor. The oil soak pit shall also be provided with a sump at the corner to allow drainage of water/oil from the soak pit. The Oil-water Separation pit, in such cases, shall be designed for an effective capacity of complete oil of one transformer having highest volume of oil along with 10 minutes of fire water. There shall be one Oil-water Separation pit for each generation unit in transformer yard area.		

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

12	VI/B	D-01	5.06.02	22 of 142	All access roads to all buildings / facilities / structures, road approaches / connections, access roads to liquid fuel storage areas and other equipment areas where access is necessary from inspection, operation and maintenance point of view and all roads inside the switchyard shall be single lane roads.	Bidder understands that roads around Fuel storage areas and Switchyard are not in Bidder's scope. Please confirm.	Roads around switchyard are not in Bidder's scope. All access roads to buildings/facilities /structures in Bidder's scope shall be in Bidder's scope. Bidder is also requested to refer amendment no. 04, S.No. 117 in this regard
13	VI/A	D-01	1.00.0	1 of 4	c. Separate RCC drainage network with GI grating cover and sump pit for plant effluents for all buildings and facilities in Bidder's scope including floor wash from main plant building area & transformer yard area.	Bidder understands that Separate RCC drainage network with GI grating cover and sump pit for plant effluents are envisaged only within Main Power House building. No other such drain is envisaged.	Query has been already replied to. Bidder is requested to refer Clarification no. 3.
14	VI/A	D-01	1.00.0	2 of 4	9. Landscaping Owner's Prebid Clarification No. 3, Page 72 of 95, Sr. no. 184 Comprehensive landscape development in the plant area under the scope of this package shall be in Bidder's scope. Bidder is requested to refer amendment to Technical Specification in this regard.	As a part of "Turbine Generator and associated package", Service building is the only non plant building included in this package. Bidder has considered landscaping work for the facilities and buildings, identified with respect to Turbine Generator and associated package. Landscaping work in remaining plant area	Comprehensive landscape development in entire plant area under the scope of this package shall be in Bidder's scope.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

	Amend ment No. 4	Sr. no. 163	Sr. no. 163	85 of 91	Development of suitable landscape and rainwater harvesting within the plant premises. Bidder shall plan to develop the landscape and rainwater harvesting from the start of the project itself. The landscape and rainwater harvesting plan shall be finalized immediately after award of work and suitable work plan with priority and schedule shall also be finalized thereafter. Top soil before excavation shall be suitably preserved and stacked for landscape and green belt development.	are excluded from Bidder's scope of work.	
15	VI/B	D-01	7.02.03 5.08.00	42 of 142 24 of 142	Following structures are to be placed <u>on pile foundation</u>: Main Power house including Control room, TGs, Service Building, <u>Transformer foundations</u>, Pipe cable gallery, any other heavily loaded structure etc. Foundations of transformers shall be designed for seismic and wind loads in addition to other applicable loads. <u>RCC block foundations shall be provided for the main transformer.</u>	Contradiction in clause. The type of foundations for transformer, either pile foundation / Block foundation shall be suitably decided by Bidder based on geotechnical investigation, to be carried out during detail engineering.	RCC Block type foundations mentioned in clause 5.08.00 refers to the type of foundation. In this particular case, block foundation shall be supported on piles. Bidder to comply the provisions of technical specification. For transformers in areas other than transformer yard, based on

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

							the loading, bidder may choose to provide either pile foundations or open foundations meeting other requirement of technical specification. Bidder is also requested to refer amendment no. 04, S.No. 129 in this regard
16		Ame ndm ent no. 4 Clari ficati on No.	Sr No. 128 Sr. No. 1	64 of 91 1 of 1	During detailed engineering, the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be lower of the two values i.e. as per approved geotechnical report and as per the values furnished in Table-1. The ground improvement scheme shall be approved by owner before execution. Bidder's Query: In order to assess the soil conditions and accordingly consider in our bid, we would like to conduct preliminary soil investigation test at few locations within the proposed plant area. We request your consent for carrying out the aforesaid activity. Also please advise us the contact	Tender condition states that Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be lower of the two values i.e. as per approved geotechnical report (to be carried out by Bidder) and as per the values furnished in Table-1 of tender specification. Hence Bidder needs to cover their risk by conducting confirmatory soil investigation at bid stage and account for the same in their proposal estimate. However, If Owner is not allowing Bidder	Provisions of Bidding Documents shall prevail.
KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW)TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371					CLARIFICATION NO. THDC/RKSH/CC-9915-371-CLRF-11		PAGE 9 OF 17

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

		06			details of site representative, who can facilitate us for the said work. Owner's Reply: Owner has carried out preliminary Geo-technical investigation in the proposed area (Please refer Cl.7.01.00 of Technical Requirements - Section VI- Part B,Sub-Section-D-01). Bidders shall consider the same for submission of their bids. Further, please also refer the provision of Cl.7.01.01(Technical Requirements - Section VI- Part B, Sub-Section-D-01) and Cl.7.01.02 (Technical Requirements - Section VI- Part B, Sub-Section-D-01) in this regard.	to conduct soil investigation before submitting price bid then Bidder shall consider tender stage soil investigation as their basis of estimation for civil, soil improvement and piling quantities. Thus lower bearing capacity, if observed during detail engineering with respect to tender specification will have price implication and shall be suitably compensated by Owner.	
17	VI/A/B	ELECTRICAL SYSTEM EQUIPMENTS _____ _____ _____ _____ Clarification	Annexure-A, Employer's Requirement which are under STG island Package, Category	11 of 15 _____ 46 of 95	Bid specification: Rating as per tender SLD Bidder's Clarification : Ratings are not indicated in the tender SLD. Owner is requested to provide rating of all the feeders indicated in Annexure A Owner's Clarification : Shall be provided during detail engineering. However, given information is sufficient for bidding purpose	Owner is requested to provide the ratings of the feeders of HT switchgears indicated in Annexure-A and Category-I. The rating will help in proper estimation and will bring all the bidders at par.	This details shall be provided during detailed engineering. However, given information is sufficient for bidding purpose.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

		n No. 03	ry I _____ Sr No. 110				
18	VI/A/B	ELEC TRIC AL SYST EM EQUI PME NTS _____ _____ _____ Clarif icatio n No. 03	Annexu re-B, Employ er's LV Switchg ears whose FO Cable& Networ king Under STGisl and Packag e _____ Sr No. 114	13 of 15 _____ 48 of 95	Bidder's Clarification : Owner is requested to provide the length of the FO cable to be considered by Bidder for the employer's system. Owner's Clarification : Please refer General layout plan in Part-E(tender drgs) for approx. calculation of FO Cable qty.	Owner to note that in Annexure-B, only the name of the boards are indicated. Location of the boards with respect to the building names are not specified in tender. Hence bidders cannot calculate the FO cable quantity. Owner is requested to provide the quantity of fibre optic cables to bring all the bidders at par.	Switchgear names are also marked in the GLP. Same can be used for FO cable quantity estimation. Hence, Bidder to follow our earlier clarification.
19	VI/A/B	ELEC TRIC AL SYST	Annexu re-A, Empl oyer's	11 of 15 _____	Bidder's Clarification : Owner is requested to provide rating of all the outgoing feeders indicated in category-II in Annexure-A	Owner is requested to provide the ratings of the feeders of HT switchgears indicated in Annexure-A and Category-II. The rating will help in proper estimation and will bring	This details shall be provided during detailed engineering.How

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

		EM EQUI PME NTS _____ _____ _____ _____ Clarif icatio n No. 03	Require ment which are under STG island Packag eCateg ory II, Employ er's switchg ear require ment _____ Sr No. 110	46 of 95	Owner's Clarification : Shall be provided during detail engineering. However, given information is sufficient for bidding purpose.	all the bidders at par.	ever, given information is sufficient for bidding purpose.
20	VI/E	TEND ER DRA WIN GS	SINGL E LINE DIAGR AM - STG PACKA GEXXX -999- POE-J- 002	- _____	Bid specification: Generator Transformer Impedance at Principal Tap = 15% (Tolerance +-5%) _____ Bidder's Clarification : Bidder requests that Generator transformer impedance at principal tap may be selected any value between 14% to 16% as against specified value of 15%. However, bidder will limit the range of transformer impedance (lowest to highest - including tolerance) from 12.5% to 17.5% as specified. Owner may please confirm.	In the revised SLD, it still indicates the impedance value as 15% at principal tap. Owner is requested to allow bidder to select any impedance values between the range of 14% and 16%, at principal tap, instead of specifying one fixed value of 15%. This will allow bidder to offer most economical design.	Bidder to comply with specification stipulations.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

	Clarification No. 03		Sr No. 133	56 of 95	Owner's Clarification : Refer Ammendmnet in this regard.		
21	VI / B Clarification No. 03	B-15 POWER TRANSFORMERS	1.11.07 II) TYPE TEST (#) ----- Sl. No. 123	20 / 36 52 of 95	Bid specification: Note: vi) **During Infra red thermography test of GT, the temperature of any part of tank shall be limited to 85 deg C. Bidder's Clarification : With an ambient temp. of 50 deg C and oil temp. rise of 35 deg C, the top oil temp. itself will be 85 deg C. Hence the temp. on tank cannot be limited to 85 deg C. We request you to kindly modify the clause as below. "During Infra red thermography test of GT, the temperature of any part of tank shall be limited to 85 deg C temp. rise over ambient temp. or 130 deg.C absolute. Owner's Clarification : Bidder to comply the specification requirement	Bidder would like to clarify that as per IEC 60076-7, Clause 7.1, Table 4, page 20, the temperature limit applicable for Other metallic, hot spot temperature (in contact with oil, aramid paper, glass fibre material) during normal cyclic loading is 140 Deg C. NTPC requirement of 85 Deg C against 140 Deg C mentioned in IEC is very stringent requirement and is a deviation from IEC guidelines. Major suppliers have denied to manufacture such transformer. Hence, bidder once again requests to review the requirement and revise the referred tender clause in line with IEC.	Bidder to comply the specification requirement.
22	VI / A	A-1 PROVENNESS	6.5.1A.2	8/14	POWER TRANSFORMERS ROUTE-2 Bidder/Sub-Vendor who have designed, manufactured and supplied at least two (2) no. 220 KV or above class transformer which are in successful operation for two (2) years and have established manufacturing facilities for 400 KV class transformers based on technological support of its associate or collaborator or technology provider or licenser, can also be considered Qualified provided its Associate or Collaborator or Technology provider or Licenser meets the qualifying requirement	Global manufacturers have established their manufacturing facility in India based on support from their parent company. Hence, bidder requests Owner to modify Route-2 of Power Transformers Provenness as below: "ROUTE-2 Bidder/Sub-Vendor who have designed, manufactured and supplied at least two (2) no. 220 KV or above class transformer which are in successful operation for two	Bidder to comply the specification requirement.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

stipulated at 6.5.1A.1 above, and:-

(i) Associate or Collaborator or technology provider or licensor provides a letter of technical support, for successful performance of the transformers, as per format, given in bidding document. This letter of technical support should be submitted prior to the placement of order on approved Sub-Vendor.

(ii) Transformer shall be of Collaborator's/ Associate's/ Technology provider's/Licensor's design. Transformer shall be manufactured in line with manufacturing & assembly drawings of Collaborator/Associate/Technology provider/Licensor.

(iii) Core coil assembly and final testing of the transformer shall be under the supervision of Collaborator/ Associate/ Technology provider/ Licensor.

(2) years and have established manufacturing facilities for 400 KV class transformers based on technological support of its associate or collaborator or technology provider or licensor **or parent company**, can also be considered Qualified provided its Associate or Collaborator or Technology provider or Licensor **or parent company** meets the qualifying requirement stipulated at 6.5.1A.1 above, and:-

(i) Associate or Collaborator or technology provider or licensor **or parent company** provides a letter of technical support, for successful performance of the transformers, as per format, given in bidding document. This letter of technical support should be submitted prior to the placement of order on approved Sub-Vendor.

(ii) Transformer shall be of Collaborator's/ Associate's/ Technology provider's/ Licensor's/ **parent company's** design. Transformer shall be manufactured in line with manufacturing & assembly drawings of Collaborator/ Associate/ Technologyprovider/ Licensor/ **parent company**.

(iii) Core coil assembly and final testing of the transformer shall be under the supervision of Collaborator/ Associate/ Technology provider/ Licensor/ **parent**

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						company."	
23	VI / A	A-1 PROV ENNE SS	6.5.2A.2		SHUNT REACTOR - 400kV 6.5.2A.2 Bidder/Sub-Vendor who have designed, manufactured and supplied at least two (2) no. 400 KV or above class transformer / 220 KV or above class reactor which are in successful operation for two (2) years and have established manufacturing facilities for 400 KV class shunt reactors based on technological support of its Associate or Collaborator or Technology provider or Licensor, can also be considered for manufacturing & supply of reactor specified under present package provided:- (i) Associate or Collaborator or Technology provider or Licensor provides a letter of technical support, for successful performance of the reactors, as per format, given in bidding document. This letter of technical support should be submitted prior to the placement of order on approved Sub-Vendor. (ii) Reactor shall be of Collaborator's/ Associate's/ Technology provider's/Licensor's design. Reactor shall be manufactured in line with manufacturing & assembly drawings of Collaborator/ Associate/ Technology provider/ Licensor. (iii) Core coil assembly and final testing of the reactor shall be under the supervision of Collaborator/ Associate/ Technology provider/Licensor.	Global manufacturers have established their manufacturing facility in India based on support from their parent company. Hence, bidder requests Owner to modify Route-2 of Shunt Reactor Provenness as below: " Bidder/Sub-Vendor who have designed, manufactured and supplied at least two (2) no. 400 KV or above class transformer / 220 KV or above class reactor which are in successful operation for two (2) years and have established manufacturing facilities for 400 KV class shunt reactors based on technological support of its Associate or Collaborator or Technology provider or Licensor or parent company, can also be considered for manufacturing & supply of reactor specified under present package provided:- (i) Associate or Collaborator or Technology provider or Licensor or parent company provides a letter of technical support, for successful performance of the reactors, as per format, given in bidding document. This letter of technical support should be submitted prior to the placement of order on approved Sub-Vendor. (ii) Reactor shall be of Collaborator's/ Associate's/ Technology provider's/	Bidder to comply the specification requirement.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						Licensors / parent company's design. Reactor shall be manufactured in line with manufacturing & assembly drawings of Collaborator/ Associate/ Technology provider/ Licensors/ parent company . (iii) Core coil assembly and final testing of the reactor shall be under the supervision of Collaborator/ Associate/ Technology provider/ Licensors/ parent company ."	
24	Amendment No. 04 Single Line Diagram- STG PKG	9915-999-POE-J-002 Rev B	Note No. 9		Supply, erection, testing and commissioning of 420KV, 125 MVAR Bus Reactor and 420KV, 80 MVAR Line Reactor is in Bidder's scope. However related civil works are not in scope of this package.	Quantity of reactor is not indicated in referred Clause no. 9 of revised SLD 9915-999-POE-J-002 Rev B. Bidder understands that Bidder has to consider 1 no. of 125 MVAR Bus Reactor and 1 No. of 80 MVAR Line Reactor in Bidder's scope. Owner may please confirm bidder's understanding.	Bidder to refer note 13 of Single line diagram 9915-999-PEO-J-002 Rev B.
25	Amendment No. 04 Single Line Diagram- STG PKG	9915-999-POE-J-002 Rev B	Note No. 9		Supply, erection, testing and commissioning of 420KV, 125 MVAR Bus Reactor and 420KV, 80 MVAR Line Reactor is in Bidder's scope. However related civil works are not in scope of this package.	Owner may please clarify the requirement of Neutral Grounding Reactor and Surge Arrestor for Line Reactor.	Requirement of Neutral Grounding Reactor and Surge Arrestor for Line Reactor shall be in bidders scope.

CLARIFICATION NO 11 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

26	VI/B	SUB SECTI ON- A-2 LAYO UT REQ UIRE MEN TS	1.02.00 (i) (3)	5 of 12	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)	Bidder understand that clear height means Floor height (including floor Beam depth+ thk for deck sheet) of HT/LT switchgear room and Boiler MCC Room. This height of bottom of structural beams from FFL shall be less than these values.	Bidder understanding is correct. Please refer amendment in this regard.
27	Section-VII, Book 1 of 3	Attachm ent-20	-----	Integrity Pact		The format of Integrity Pact provided under Attachment-20 is not signed by Employer. In line with practice followed by other Central/State Utilities, we request to kindly provide the Integrity Pact duly signed by Employer.	The bidders are required to submit the Integrity Pact duly signed by their authorized representative along with their bid.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT	DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
1	V (SCC)	-	3 of 31	5.0 (GCC 7.3.1.8)	Further in case of discontinuance of manufacture of any spares by the Contractor / SG manufacturer, Contractor will provide the Employer, two years in advance, all manufacturing drawings, material specification and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/ procurement of such items.	It is clarified that information that is proprietary in nature cannot be shared with employer.	Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
2	VII/ A	A-1	11 of 14	7.1	The DDCMIS supplier(s) of STG integral controls and BOP-C&I- TG should have engineered, supplied, and commissioned/ got commissioned their respective control systems in at least one (1) unit of rating 200MW or above in a power station(s).	It is clarified that state of art BHEL make Valmet DNA DCS control system has been offered for the package including TG controls. The same is indigenously designed, engineered, manufactured and tested at BHEL electronics division works, Bengaluru. The reference list, technical write up and other C&I facilities has been enclosed as part of the technical offer.	Bidder agreed to withdraw the deviation
3	VII/ A	A-1	12 of 14	7.6	SWAS and Vibration Monitoring system offered for this package shall be same or of same series which should have been in successful operation for a period of not less than one(1) year in at least one(1) unit of rating 200MW or above in a power station.	It is clarified that BHEL make Valmet DNA (Formerly Metso DNA) Vibration monitoring system has been offered for the project.	Bidder agreed to withdraw the deviation
4	VII/ A	IIC	3 of 33	1.11.01	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.	It is clarified that the specified execution of works shall be considered only for systems/ equipment falling under the scope of TG package of project. Field instruments/ field bus system is not envisaged for SG and SG BOP applications.	Bidder requested to consider the deviation
5	VII/ A	IIC	7 of 33	2.03.05	The Contractor shall provide integrated HART system for centralized configuration, maintenance, diagnosis & recordkeeping for all electronic transmitters, control valves & analyzers with HART protocol. DDCMIS AI (4-20 mA) cards shall be HART enabled. Separate HART system is not acceptable.	It is clarified that HART management system has been offered only for the applicable instruments of those under TG package of the project. HART management system is not envisaged for SG, SG BOP etc., areas	Bidder agreed to withdraw the deviation

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT	DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
6	VI/ A	IIC	8 of 33	2.04.02	In addition to operation of complete TG C&I system from the HMI of STG C&I DDCMIS, unit TG DDCMIS including TG Standalone DDCMIS shall also be interfaced with the SG C&I DDCMIS (being procured by Employer under separate package) at control system level for operation & monitoring of unit TG DDCMIS and TG Standalone DDCMIS drives from the HMI of SG C&I DDCMIS, in order to realize a single Unified HMI interface for the entire main plant in the Unit Control room. Drives of unit TG DDCMIS including TG Standalone DDCMIS will be operated in real time from Unified HMI.	We understand that unified HMI shall be implemented by SG contractor on SG DDCMIS platform. Bidder shall provide required interface with SG DDCMIS for implementation of unified HMI on SG DDCMIS.	Bidder agreed to withdraw the deviation
7	VI/ B	IIIC-02	24 of 26	13.02.00	No repairs/ replacement shall normally be carried out by the Employer when the plant is under the supervision of Bidder's supervisory engineers. If in the event of any emergency in the judgment of employer, delay could cause serious loss or damage, repairs may be made by the employer or a third party chosen by the employer without advance notice to the bidder and the cost of work shall be paid by the bidder.	It is clarified that any unauthorized repairs/ replacement during warranty period shall affect the warranty obligations and the provision of warranty stands cancelled there upon. Bidder shall not be liable to pay for the charges of repair/ replacement or for the damages caused due to the unauthorized service.	Bidder agreed to withdraw the deviation
8	VI/ B	IIIC-02	24 of 26	13.06.00 15.00.00	In order to discharge the warranty responsibility, the bidder shall include in his proposal lumpsum price for the provisions of a team of service personnel at Site who will be fully qualified to perform the required duties throughout the warranty period of one year. The Bidder shall deploy at least one engineer, one supervisor and two technicians in the team. REMOTE SERVICE CENTRE	Remote service center connectivity (RSC) is applicable for the package. Warranty obligations if any can be met through the RSC. Expert service deputation can be provided in case of critical/ pertinent issues. Deputation of huge service personnel during warranty period is not required and hence not envisaged.	Bidder requested to consider the deviation
9	VI	IIC-01	9 of 33	2.04.10	Redundant TG LAN for connecting Unit STG C&I DDCMIS & other subsystems of DDCMIS (viz. TG-SAC DDCMIS system) using Layer-3 Switch is to be provided in this package. Station LAN for interfacing with third party systems like ERP, PLCs, PADO etc. with firewalls using DMZ servers is being procured by Employer separately. This shall include all cables and accessories required for connecting Contractor's system upto the Employer's systems. Alternatively, Bidder's standard & proven solution, which is functionally equivalent to redundant system bus and single fault tolerant, shall be acceptable.	Since station LAN is being provided by employer under SG package, the same is not envisaged separately for TG package. The TG DDCMIS shall be interfaced to employer station LAN	Bidder agreed to withdraw the deviation
10	VI	IIC-01	9 of 33	2.04.10	Redundant TG LAN for connecting Unit STG C&I DDCMIS & other subsystems of DDCMIS (viz. TG-SAC DDCMIS system) using Layer-3 Switch is to be provided in this package. Station LAN for interfacing with third party systems like ERP, PLCs, PADO etc. with firewalls using DMZ servers is being procured by Employer separately.	The terminal point for connectivity to employer systems shall be the suitable terminal block/ port at bidder's equipment/ system.	Bidder agreed to withdraw the deviation

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL								
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
11	VI/A	Terminals points & exclusions	3 of 6	7.02.00	Terminal points Employers DDCMIS marshaling cabinets for hardwired signal exchange from SG C&I & BOP C&I control systems Upto and including local junction boxes or Integral junction box of LIE/LIR for primary instruments including temperature transmitters for all instruments related to SG C&I & BOP C&I including CW system in Employer's scope which are being connected to the Contractor's control system.		The terminal point for hardwired signal exchange with employer's SG/ BOP C&I DDCMIS shall be the terminal blocks of bidder's DDCMIS.	Bidder agreed to withdraw the deviation
12.	VI/C	GTR	38 of 89	9.02.23 (2)	Burn in Test Cycle .. 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.		Burn in test shall be conducted for a period of 10 Hrs for a suite of two panels as a sample. This is a standard practice being followed for all power plants being executed by Bidder and the same is adequate.	Biddrer to refer amendment in this regard.
13.	VI/ A	III-C	32 of 33	18.00.02	The Contractor shall provide warranty spares including components for each system based on (and keeping adequate over margin) normally experienced failure rate.... The warranty spares as per the list mentioned above will be dispatched by the Contractor along with the main equipment consignment.		Bidder shall be responsible for ready and timely availability of all warranty spares as required. Required stock of spares shall be made available as and when required at site. List of warranty spares shall therefore not be applicable and it is not envisaged to desptach them to site along with the main equipment	Bidder agreed to withdraw the deviation
14.	VI/ Part B	IIIC-18	9 of 10	11.02.01	Single Input /Dual Input Temperature transmitter Output FOUNDATION fieldbus /PROFIBUS PA		It is clarified that Profibus compatible Temperature Multiplexers have been offered instead of separate temperature transmitters.	Bidder agreed to withdraw the deviation
15.	VI/ Part B	III-C-02 Annex IIIC-02K	1 of 3	1.04.01	Redundant host/ master card and redundant power supply along with advance diagnostic module shall be provided.		It is clarified that diagnostic and gateway modules are non-redundant.	Bidder agreed to withdraw the deviation
16.	VI/ Part B	III-C-02 Annex IIIC-02K	2 of 3	1.05.00	SS Junction boxes specially designed for fieldbus application shall be provided on as required basis. These SS JB's shall house field mounted fieldbus components like distributors, tee, etc.		In view of non-hazardous safe area, IP-55 class cabinets are offered for mounting of field components of PROFIBUS. SSJB is not envisaged.	Bidder agreed to withdraw the deviation
17.	VI/ Part A	II-C	3 of 33	1.11.02 (C)	Loop Reaction Time (time between field acquisition to field output in control system): .. b. For other Closed loop controls, conventional/ fieldbus based/ mixed, loop reaction time shall be 500 ms or better as per process requirement. .. d. For other Open loop controls, conventional/ fieldbus based/ mixed, loop reaction time shall be 1 Second or better as per process requirement.		The loop reaction time severely depends on the type of profibus instrument being used. The minimum scan time for PROFIBUS based system shall be 1 Sec. Loop reaction time for fieldbus shall be decided during detailed engineering based on the number of devices per segment and the process requirements.	Bidder agreed to withdraw the deviation

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT	DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
18	VI/ Part A Amendment 14	II-C Amendment 14	10 of 33 13 of 15	2.04.15 Sl. No. 28	DDCMIS vendor shall upgrade/ update all DDCMIS system along with Station LAN to the latest version/ release of DDCMIS system software/ patches, meeting the system software requirements as mentioned in Part-B, SUB-SECTION-IIIC-02 DDCMIS. This shall include the latest OS and its corresponding latest version/ release of DDCMIS system software/ patches. The upgrade/update shall be checked for and carried out six months before the completion of AMS of last DDCMIS (whose AMS started last). Any change in hardware and the requisite services (engineering/ erection/ commissioning/ documentation) required for the same shall also be carried out by the contractor within the contract price.	It is clarified that latest version of hardware/ OS/ application software/ station LAN shall be configured as available at the time of detailed engineering. Bidder confirms that in case of any software patches, to take care of software bugs etc., for the original version of hardware/ software shall also be taken care during the execution of contract including applicable AMC period. Further replacement/ repair of hardware shall also be provided in case of failure during AMC period as per the contract. The implementation of any latest software upgrades viz., OS etc., at the end of 6 months before AMC period shall be based on availability of Microsoft support for the supplied OS as per Microsoft's Life cycle support policy and availability of compatible/proven DDCMIS software at that point of time.	Bidder agreed to withdraw the deviation
19	Section-VI , Part-B	A-8	65 of 92	6.08.03(b)	Statically and Dynamically balanced rotor.	Static balancing is not required as dynamic balancing up to rated speed is done as per API 612. This is in line with standard practice followed for all NTPC Projects.	Bidder agreed to withdraw the deviation.
20	Section-VI , Part-B	A-8	65 of 92	6.08.04(b)	Stop Valves to be provided with removable stainless steel steam strainer for normal operation and one additional strainer element shall be provided for initial operation.	Customer to note that during steam blowing of MS line (initial operation), strainer is removed and blanking fixture is used to isolate the steam turbine from steam. Hence we do not need any temporary fine mesh strainer for commissioning as per BHEL proven design. Blanking device will be supplied by BHEL.	Bidder agreed to withdraw the deviation.
21	Section-VI , Part-B	A-8	65 of 92	6.08.04(g)	Stop valves to have provision for on load testing.	ATT is not applicable for this size and range of Industrial Turbines. However, we confirm that on load testing of ESV to ensure freeness is provided.	Bidder agreed to withdraw the deviation.
22	Section-VI , Part-B	A-8	66 of 92	6.08.07(a)	One AC motor driven main oil pump One AC motor driven auxiliary oil pump	We propose to consider Horizontal centrifugal pump for Main oil pump and Auxiliary oil pump. Customer is requested to confirm.	Bidder agreed to withdraw the deviation.
23	General				overspeed protection.	An independent electronic over speed protection in 2 out of 3 logic is considered, which is in addition to one over speed protection in electronic governor. Hence mechanical (bolt trip) over speed protection device, being obsolete system, is not provided.	Bidder agreed to withdraw the deviation.
24	API 612- 6th edition deviations			10.4	Unless otherwise specified, condensing turbines shall be provided with at least two grounding brushes on the same end of the shaft.	One number grounding brush will be provided due to space constraints in the bearing housing. This is in line with all NTPC Projects.	Bidder agreed to withdraw the deviation.

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SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT	DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
25	Section-VI, Part-B	IIIC-3	5 of 5	3.02.00-01c	Stop valve metal temperature	Stop valve metal temperature is not applicable as TSE is not applicable for BFP drive turbines. This is in line with all NTPC Projects.	Bidder agreed to withdraw the deviation
26	Section-VI, Part-A	IIA-5	3 of 10	2.02.08	Portable turbine preservation system consisting of adequate numbers of air driers including, fans, motors, filters, heater drying wheel, connecting pipings, valves, fittings etc. for preservation against corrosion of turbine during idle periods shall be provided. One number system per station shall be provided.	Separate turbine preservation systems are not considered for BFP drive turbine as per our standard scope of supply to all thermal power projects. We presume these are specified for main Steam Turbine as per our understanding. Customer is requested to confirm above.	Bidder agreed to withdraw the deviation.
27	Section-VI, Part-B	A-3	15 of 92	1.13.00 (d)	INSULATION (STEAM TURBINE AND BFP): 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. This	Drive Turbine will be insulated with mineral wool mattress and CAT-9 cement as final layer. This is as per our proven practice for all thermal power projects.	Bidder agreed to withdraw the deviation.
28	Section-VI, Part-B	B-5	2 of 4	1 (a)	Performance Tests on each Boiler Feed Pump to determine the characteristic curve (Head, Capacity, Efficiency & Power) at Design Speed and to ensure compliance with design requirements specified in the specification.	Performance Test of BFP: Performance test on BFP will be conducted at reduced speed and power and the results will be extrapolated to the specified conditions as per HIS, since it is not feasible to conduct full load, full speed tests at works.	Bidder agreed to withdraw the deviation.
29	Section-VI, Part-B	B-5	2 of 4	1 (a)	Measurement shall be carried out at 10%, 25%, 50%, 65%,80%, 100% & 125% of Design Flow with loop water at design temperature. Performance Test at other specified Conditions shall be carried out on all Boiler Feed Pumps at their respective Speeds at design temperature.	Performance Test of BFP: Performance test measurement shall be carried out at 25%, 50%, 65%, 80%, 100% & 125% of design flow. Performance test measurement at 10% of design flow is not envisaged. Since, the BFP is a very high energy pump and hence running the pump nearer to closed valve condition is not recommended.	Bidder agreed to withdraw the deviation.
30	Section-VI, Part-B	B-5	2 of 4	3 (a) & (b)	Vibration & Noise Level tests on BFP & BP	Vibration & Noise Level readings taken during the shop tests for all pumps are for informative purpose only. These levels may be higher than the specified values in view of the presence of valves located in the test pit piping with-in close proximity of the pump due to layout constraints and the temporary foundation arrangement of the test set up. Vibration & Noise Level on BFP & BP will be demonstrated during performance test at site.	Bidder agreed to withdraw the deviation.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
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	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
31	Section-VI, Part-B	A-3	43 of 92 & 70 of 92	4.01.00 & 6.10.00	Type Test(s) to be conducted	Type tests for TDBFP, TDBP, MDBFP, MDBP & CEP: 1) NPSH test on BFP,BP & CEP. 2) Pressure pulsation test on BFP 3) Dry running withstand capability test on BFP and BP 4) Axial thrust measurement test of BFP 5) Visual cavitation test on BFP BHEL request waiver for above tests on TDBFP, TDBP, MDBFP, MDBP & CEP for which special tests mentioned were successfully demonstrated on the identical pumps supplied for previously executed 660MW NTPC projects. However, type test results and reports of tests conducted will be furnished during project execution.	Bidder agreed to withdraw the deviation.
32	SECTION-VI , PART-B	A3	50 OF 92	5.02.00.g	Hardened 400series stainless steel impingement plates for flashed drain inlet from HP heaters, BFP recirculation, boiler startup drains etc.	Hardened 304 series stainless steel impingement plates will be provided for flashed drain inlet from HP heaters, BFP recirculation, boiler startup drains etc.	Bidder requested Employer to consider the deviation.
33	SECTION-VI , PART-B	A3	52 OF 92	5.02.00.(o) & (p)	Maximum oxygen content shall be 0.005 cc/lit at deaerator outlet measured as per ASTM-D-888 ref-erence method-A or Indigo carmine method at all operating con-dition. Free carbon dioxide as measured by APH method shall be non-traceable at all load.	All super critical units operated in oxygenated treatment mode and hence guarantee for maximum oxygen content in feed water system is not applicable for super critical sets. Further during oxygenated treatment mode, all the Deaerator vent valves remain closed. Hence, Guarantee for carbon dioxide content is also not applicable for supercritical sets.	Bidder agreed to withdraw the deviation.
34	SECTION-VI , PART-B	A3	52 OF 92	5.03.01.(d)	Tubes to be welded to tube sheets and then hydraulically expanded.	Tubes to be welded to tube sheets and then rolled expanded.	Bidder agreed to withdraw the deviation.
35	SECTION-VI , PART-A	A3	5 OF 10	6.01.00	Centralised Nitrogen gas filling arrangement	Provision for N2 charging is available on all the Equipment covered under this section. As per standard practice, equipment are charged one by one on need basis with commercially available N2 cylinders at the equipment point. Centralised N2 gas filling system is not recommended. Also such system is not widely prevelant in Indian Power Plants currently. Customer is requested to confirm the above.	Bidder agreed to withdraw the deviation.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
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	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
36	Section-VI, Part-A	Mandatory Spares	12 of 59	B-V.10	Electrohydraulic assembly for governing system of TDBFP,s	Electrohydraulic actuator assemblies in governing systems are generally employed in high pressure governing systems where the control oil pressure is at 160 bar and above. The governing system valve actuator assemblies used in the TDBFPs are low pressure (8 bar) hydraulic actuators which receive only hydraulic signals generated by the IH (current to hydraulic signal) converters mounted in the console. Hence, the EHA assembly is not applicable for TDBFPs. Governing system for TDBFP includes Governing valves, Servo Motor & EHC. Spares for these items are covered in the customer's spares list.	Bidder agreed to withdraw the deviation.
37	Section-VI, Part-A	Mandatory Spares	17 of 59	C-4	Coupling between motor and pump with bolts , bush ,locking pin etc.	Complete coupling for CEP is already covered at clause no-A-13. Hence same will not be	Bidder agreed to withdraw the deviation.
38	Section-VI, Part-A	Mandatory Spares	18 of 59	C-11a-VI	Complete coupling assembly. Between BFP to Turbine, Turbine to Gear box, Gear box to Booster pump, Booster pump to BFP motor, Hydraulic coupling to BFP	Complete couplings between Booster Pump to Gear Box, Gear Box to Drive Turbine are already covered at clause no-A-11(a) and A-12. Hence same will not be supplied against this clause. Only coupling between TDBFP & Drive Turbine will be supplied against this clause. Coupling for MDBFP train is quoted under MDBFP heading.	Bidder agreed to withdraw the deviation.
39	Section-VI, Part-A	Mandatory Spares	19 of 59	C-12-VI	Complete coupling assembly. Between BFP to Turbine, Turbine to Gear box, Gear box to Booster pump, Booster pump to BFP motor, Hydraulic coupling to BFP	Couplings for TDBFP already covered under TDBFP heading. Hence same not quoted against this clause. Complete couplings between Booster Pump to Motoris already covered at clause no-A-11(b). Hence same will not be supplied against this clause. Only coupling between MDBFP to Drive Hydraulic Coupling and Hydraulic Coupling to MDBFP will be supplied against this clause.	Bidder agreed to withdraw the deviation.
40	Section VI/Part B	Subsection B-02	2 of 9	3.01.00 b)	HT motors shall have minimum design efficiency of 95 %.	Small rating motors having high inertial like Mill and crusher application shall have efficiency lower than 95 %.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
41	Section VI/Part B	Subsection B-02	4 of 9	7.06.00	Noise level for all the motors shall be limited to 85 dB (A) except for BFP motors for which the maximum limit shall be 90 dB (A). HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmx80mm vibration pads.	Noise level for 2 pole motors shall be 90 dB (A). Vibration pad for vertical H compact motors shall be 16 x 30 x30 mm cube and horizontal H Compact motor 40 mm cube.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
42	SECTION VI PART B	SUB SECTION B-14	9 of 15	8.04.00	The radiator tubes shall be of copper with sufficient heat transfer area.	The radiator tubes shall be of copper or aluminium alloy as per manufacturer standard.	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL								
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
43	SECTION VI PART A	MANDATORY SPARES	53 of 59	9	Generator Bearing Sheets		Not applicable. Flexible disc in single bearing alternator for coupling will be provided.	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
44				10	Rotor Pole Coil		Not applicable	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
45				11	Battery Charging Rectifier Diodes- 4no.s		One no. spare charger power section will be provided. Charger may be SMPS type.	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
46				13	Fuses for the excitation diodes		Not applicable	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
47				33	Overspeed Stop		Not applicable	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
48				34	Resistor for Desel Generator		Not applicable	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
49				35-37	Various filter elements		Filter elements are made of paper and subject to deterioration with time. Same should be purchased as and when required.	The Technical specification is clear Bidder to comply Technical specification. Hence
50				38	Plate corr. Resistor for Diesel Engine		Not applicable	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
51				52	Starting air motor		Not applicable. One no electric motor for battery start will be provided.	The Technical specification is clear Bidder to comply Technical specification. Hence Bidder agreed to withdraw deviation.
52	VI/B	D 01 Civil Works	42 of 142	7.02.02 j)	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:		Please furnish the total permissible settlement requirement for different structures as the table for the same is not legible in the tender document.	Relevant table Handed over during discussion.

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Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL								
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	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
53	VI/B	D 01 Civil Works	20 of 142	5.05.00	Further, these drains shall also be provided with heavy duty galvanized MS gratings with.....		MS grating made up of 40 mm X 6mm thick flats spaced at a distance of 75mm is being provided for taking load over 0.75 T/sqm . Please accept. If not acceptable, Owner is requested to confirm the loading range for classifying the gratings as Heavy Duty.	The said paragraph of Technical Specification reads <i>"The drains along the side of the peripheral roads of BTG areas shall be covered with cast-in situ/ precast RCC cover with minimum 200mm thickness designed for all crane /vehicular loads. Further, these drains shall also be provided with heavy duty galvanized MS gratings with opening of 1mx 1m at 7.5m center-to-center interval. The drains inside the BTG area shall be as described in Area Paving clause of technical specification."</i> Grating specified in above paragraph shall be designed for the same crane/vehicular loading for which the precast members are to be designed.
54	Section-VI, Part-A	Technical Specification	B.11.01.01	-	Complete Fire detection and protection system is excluded except Inert gas fire extinguishing system and fire detection & alarm system required for activation of Inert Gas System.			Bidder agreed to withdraw deviation and specification requirement shall be complied with.
55	SECTION-VI / PART-B	SUB SEC-B-7	2 OF 11	6.01.01	The system shall be suitable to ensure air leakage of not more than 5% of total enclosure volume per hour.		Air leakage rate will be in accordance with IS 8084 Appendix-F Cl. F-4.2.	Necessary amendment shall be issued.
56	Section-VI/ Part-C/ General Requirements- Quality Assurance	Quality Assurance	34 of 89	9.02.05	No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).		MDCC shall be applicable for QP items only. Basis for issuance of MDCC shall be categorized as under: 1). Cat-A items : For Cat-A items, customer inspection reports shall be base. 2). Cat-B items : For Cat-B items, BHEL shall submit the inspection reports. 3). Cat-C items : Rest Non QP items shall be under catergy Cat-C, wherein BHEL will submit only the Certificate of Conformance (COC).	Bidder agreed to withdraw the deviation.

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SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
57	Amendment No. 04 to Bidding Specification Cl. No 17.00 / VI Part-A / Mand. Spares / Page 4 of 59 & General Note	Mandatory Spares	5 of 91 & 7 of 91	14 & 31	Cl. 17.00 / Vol-VI / Part-A / Mandatory Spares ~~If the same spare(s) is appearing at two different places, spare has to be considered at only one place, in order to avoid any duplicity.~~ Amendment 04: If any item appears in more than one groups (Group A, B, C) same shall be considered by the bidder irrespective of duplicity and price shall be considered accordingly.		Refer Sr.No. 391 and Sr. No. 448 of Clarification No. 03 to Bidding Documents issued by THDC for Khurja (2x660MW) : SG Package. The same is reproduced below: Sr.No. 391 / 2. In the event of repetition of spares, bidder will not considered the repeated spare for the same item. Sr. No. 448 - Mandatory spares duplicated at different clauses in Mech/Elec/C&I sections, bidder will consider the spare as per the section where higher qty is specified. Other sections will be ignored for the same spares. THDC Clarification / Response : Bidder's Understanding is correct. Therefore, Bidder request THDC to follow the same understanding regarding duplicacy of Spares as being confirmed in SG bid. THDC to accept.	Bidder agreed to withdraw the deviation.
58	Amendment No. 04 to Bidding Specification General Note / VI Part-A / Mand. Spares / Page 4 of 59	Mandatory Spares	7 of 91	30	General Note / Vol-VI / Part-A / Mandatory Spares (Page 59 of 59) ~~In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the mandatory spares list.~~ Amendment 04: Bidder shall not indicate "Not Applicable" against any of the spare (except for those items for which "if applicable" is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules.		Incase of Not Applicability, Functionally Equivalent Spares shall be offered against the Relevant Clause of Spares List. THDC to confirm.	Bidder agreed to withdraw the deviation.
59	Section-VI / Part-A	Mandatory Spares	5 OF 59	Group A/2	Complete assembly of IPT inner bladed casing and bladed rotor including all internal in assembled condition along with full set of both ends of stationary gland seal segments(Finned)	1 No.	Bidder has offered 1 no. complete assembly of IP Turbine without Outer casing. THDC to accept.	Bidder agreed to wothdraw the deviation.

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SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
60	Section-VI / Part-A	Mandatory Spares	6 OF 59	Group A/6	Aux oil pump complete assembly for Main Turbine along with complete coupling	1 No.	Auxiliary oil pump is not applicable as Turbine lubrication oil system envisages 2x100% AC oil pump as per our collaborator's standard practice. However, 1 no. Motor Driven Main Oil Pump for Main Turbine along with complete coupling is being offered in place of Auxiliary Oil Pump. THDC to accept.	Bidder agreed to withdraw the deviation.
61	Section-VI / Part-A	Mandatory Spares	6 OF 59	Group A/7	Main oil pump complete assy (Turbine Driven). (If turbine driven MOP is not there then no requirement).	1 No.	Not Applicable as MOP is motor driven.	Bidder agreed to withdraw the deviation.
62	Section-VI / Part-A	Mandatory Spares	8 OF 59	Group B/I.12	Turning Gear assembly complete (including gear internal with shafts, bearing, bushes, lock washers,	1 set (Requirement	In lieu of Turning gear assembly, 1 No. complete Hydraulic Turning Motor is being	Bidder agreed to withdraw the deviation.
63	Section-VI / Part-A	Mandatory Spares	10 OF 59	Group B/I.31	Tube nest assembly for Vacuum Pump Cooler	1 No.	In lieu of Tube nest assembly for Vacuum Pump Cooler, 1 no. Plate type Heat Exchanger is offered.	Bidder agreed to withdraw the deviation.
64	Section-VI / Part-A	Mandatory Spares	14 OF 59	Group B/IX. 11.(ii)	AC JOP motor for main turbine	1 No	As per SI.No. 1 of Amendment No. 14, AC JOP motor for main turbine is to be offered at Cl.No. 8 of Group- A Mandatory Spares. To avoid repetition of spares, the same is not offered here again. THDC to accept.	Bidder agreed to withdraw the deviation.
65	Section-VI / Part-A	Mandatory Spares	14 OF 59	Group B/IX. 11.(iii)	All DC Motor	1 no of each type & rating	DC Motors that are not covered elsewhere, will only be offered against this clause. THDC to accept.	Bidder agreed to withdraw the deviation.
66	Section-VI / Part-A	Mandatory Spares	15 OF 59	Group C/ 3.vii	a) LP turbine atmospheric diaphragm (Complete set for replacement of one diaphragm assembly) with studs	1 No	Studs are not applicable due to welded connection with casing.	Bidder agreed to withdraw the deviation.
67	Section-VI / Part-A	Mandatory Spares	16 OF 59	Group C/ 3.xviii	Vapour extractor for lube oil with motor	1 No	Vapour extractor for lube oil with motor is not applicable. However in lieu of this, its equivalent 1 no. Air Breather has been offered.	Bidder agreed to withdraw the deviation.
68	Section-VI / Part-A	Mandatory Spares	16 OF 59	Group C/ 3.xx	Basket strainer/ Filter for Lube Oil/ Control Fluid system in tank - if applicable	2 sets (Requirement for two units)	a) In case of Lube oil system, instead of Filters, Basket Strainers are provided in Lube oil tank. Accordingly, basket strainers are offered. b) However for control fluid system Basket strainer/ Filter in control fluid tank is not applicable.	Bidder agreed to withdraw the deviation.
69	Section-VI / Part-A	Mandatory Spares	16 OF 59	Group C/ 2.ii	Soft packing like gaskets, gland packing, O rings for HPSV, HPCV, HPBYPASS VALVE, HPBYPASS SPRAY VALVE, IPSV, IPCV, LPBYPASS SV, LPBYPASS CV	2 sets for each valve	Soft packing like gaskets, gland packing, O rings are not applicable in case of HP Stop & control Valve.	Bidder agreed to withdraw the deviation.

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70	Section-VI / Part-A	Mandatory Spares	17 OF 59	Group C/ 3.i	Vacuum Pump for Main Turbine Condenser i) Complete rotating assembly with Impeller, rotor & coupling.	1 No	Complete assembly of 1 no. Main Turbine Condenser Vacuum Pump including Complete Coupling is already offered at Cl.No. 14 of Group- A Mandatory Spares. To avoid repetition of spares, the same is not offered here again.	Bidder agreed to withdraw the deviation.
71	Section-VI / Part-A	Mandatory Spares	17 OF 59	Group C/ 5.ii	Shell side safety relief valve for the following : All LP heater	1 set (Requirement for one unit)	As LP Heater 1 & 2 will be inside condenser, the shell side relief valve is not applicable for LP heater-1 & 2.	Bidder agreed to withdraw the deviation.
72	Section-VI / Part-A	Mandatory Spares	24 OF 59	Group C/ 19.2/e	Gas System H2 gas regulator from cylinder to manifold	10 nos.	Quantity specified against this spare item i.e. 10 no.s, is on quite higher side as 2 no.s of each type of H2 gas regulator is mounted in the main skid. Hence, 2no.s of each type shall be offered. THDC is therefore requested to accept the quantity 2 Nos instead of 10 Nos.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
73	Section-VI / Part-A	Mandatory Spares	24 OF 59	Group C/ 19.2/f	Gas System CO2 gas regulator from cylinder to manifold	3 nos.	Not Applicable as per scheme of Gas System proposed by the bidder.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
74	Section-VI / Part-A	Mandatory Spares	24 OF 59	Group C/ 19.2/g	Gas System Temperature and Pressure switches	1 No. of each type	Temperature and Pressure switches are Not Applicable. However its equivalent spares - RTDs and pressure gauges shall be offered against relevant Cl.No. 2.00.00/ 3.b.(i) and 3.d of C&I - Mandatory Spares.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
75	Section-VI / Part-A	Mandatory Spares	24 OF 59	Group C/ 19.2/i	Gas System Thermometers	1 No. of each type & range	Not Applicable as thermometers are not used in Gas System.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
76	Section-VI / Part-A	Mandatory Spares	24 OF 59	Group C/ 19.3/d	Seal Oil System Differential pressure gauge	3 nos.	Not Applicable as per scheme of Seal oil System proposed by the bidder.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
77	Section-VI / Part-A	Mandatory Spares	24 OF 59	Group C/ 19.3/f	Float for level regulator	1 No. (if applicable)	Float valve of Seal Oil system has already been covered at Cl.No.19.3 a. Float for level regulator is not applicable & hence not offered.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
78	Section-VI / Part-A	Mandatory Spares	25 OF 59	Group C/ 19.4	Control fluid oil vapour exhaustor motor	1 No.	Not Applicable as Control fluid oil vapour exhaustor is not applicable & hence not offered.	Bidder agreed to withdraw deviation and comply with technical specification requirement.
79	Section-VI / Part-A	Mandatory Spares	28 of 59	Group C/ 23a	Steam traps and Y-Strainers Steam trap & Y strainers up to 25 NB	10 nos. of each type, material, size & class per unit	Y-strainers are not applicable .	Bidder agreed to withdraw the deviation
80	Section-VI / Part-A	Mandatory Spares	28 of 59	Group C/ 23b	Steam traps and Y-Strainers Steam trap & Y strainer above 25 NB & up to 50 NB	5 nos. of each type, material, size & class per unit	Steam trap is not applicable .	Bidder agreed to withdraw the deviation
81	Section-VI / Part-A	Mandatory Spares	28 of 59	Group C/ 23c	Steam traps and Y-Strainers Steam trap & Y strainer above 50 NB	2 nos. of each type, material, size & class per unit	Steam traps & Y strainers are not applicable .	Bidder agreed to withdraw the deviation

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL								
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
82	Section-VI / Part-A	Mandatory Spares	40 of 59	C&I Mandatory Spares 7.00.00/ A/ 1	a. Electro-Hydraulic Converter/Servo unit/ proportional valve for main turbine b. Blocking unit for main turbine (as applicable) c. Position feedback transmitter of EHC & Position feedback transmitter of Stop Valves & Control Valves for main turbine (as applicable)	1 Set	1. EHC is Not Applicable, however its equivalent item "Servo Valve" is already specified at Cl. No. I.34 of Group-B (Page 10 of 59). To avoid repetition of spares, the same is not offered here again. 2. Blocking Unit is Not Applicable.	Bidder agreed to withdraw the deviation
83	Section-VI / Part-A	Mandatory Spares	40 of 59	C&I Mandatory Spares 7.00.00/ A/ 2	a. Electro-Hydraulic Converter/Servo unit/ proportional valve for LPBP b. Blocking unit for LPBP (as applicable) c. Position feedback transmitter for LPBP d. Positioner for LPBP e. Solenid Valves	1 Set	1. EHC is Not Applicable, however its equivalent item "Servo Valve" is being offered. 2. Blocking Unit & Positioner is Not Applicable.	Bidder agreed to withdraw the deviation
84	VI / A & VI / C /	A-2 GTR	1 of 3 & 28 of 89	1.03.00 & 8.10.01	Lube Oil & FRF : All the first fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids / control fluids...etc. Bidder shall 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) which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate Containers. Bidder shall also supply a quantity not less than 10% of the full charge 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~~		Clause 1.03.00 & 8.10.01 are contradictory. Bidder understand that a quantity not less than 10% of the full charge of each variety of lubricants to be supplied in seperate containers, which is expected to be utilised during the first year of operation / topping up. Therefore Lube Oil & FRF quantity required for First Fill + 10% of full charge is to be supplied.	Bidder requested Employer to consider the Deviation
85	VI / A	A-3	2 of 10	2.02.04	Steam turbine control fluid and its purification system along with its conditioning system shall be complete with control fluid tank, control fluid pumps with drive motors, strainers, accumulator, control fluid coolers, waste fluid tank, purification equipment including fluid circulation pumps with drive motors, associated piping, valves, fittings and		The control fluid system as per supplier's design concept does not include a "waste fluid tank".	Bidder requested Employer to consider the Deviation
86	VI / A	A-3	2 of 10	2.01.04	Turbo generator set shall be suitable for installation on solid RCC foundation as well as spring supported Reinforced Cement Concrete (RCC) foundation		Bidder recommends Solid RCC foundation without Spring support (VIS)	Bidder agreed to withdraw the deviation
87	VI / A	A-3	9 of 10	12.10.00	Operating platform around the deaerator, GSC, flash tanks, lube oil/ control oil tanks, HP/LP bypass valves, Emergency Stop Valves / Intercept valves, local platforms for various inaccessible valves and equipments etc. shall be in contractor's scope		Operating Platform around Control Fluid tank is not required and not envisaged.	Bidder agreed to withdraw the deviation.

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88	VI / A	A-3	9 of 10	13.00.00	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.	Bidder understand that for Steam Turbine & Generator, only One set of tools & tackles is required to be supplied for the plant.	Bidder agreed to withdraw the deviation
89	VI / B	A-01	2 of 3	1.04.00	The plant shall be designed to operate continuously under two shift and cyclic modes. The design would cover adequate provision for quick startup and loading of the units to full load at a fast rate. The unit shall have minimum rate of loading or unloading of 5% per minute above the control load (i.e. 50% MCR). Plant shall be capable of minimum N1 number of daily load cycles (N1 shall not be less than 2), i.e. load variation from 100% to 50 % (and vice versa) of MCR without affecting the design life of turbine systems. In addition, the plant shall also be capable of minimum N2 number of daily load cycling (N2 shall not be less than 1) from 50% to 30% (and vice versa) of MCR with a minimum ramp rate of 3% per minute without affecting the design life of turbine systems	Bidder understand that the Mode of Operation of the plant is as "Base Load" as per Specification Clause 3.00.00 of VI-A-A-0, Page 1 of 13. Hence, the clause 1.04.00 of VI-B-A-01 at Page 2 of 3 to be deleted. Availability of Steam Parameters from the SG supplier to be informed for all the conditions.	Bidder agreed to withdraw the deviation.

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90	VI / B	A-01	2 of 3	1.05.00	Bidder shall furnish, within 6 (six) months from the date of placement of award / during detail engineering, following details: 1. 'Fatigue Damage', resulting from a. The number of Cold start up, Warm start up and Hot start up as defined elsewhere in the specification and b. Load cycling during defined plant life. 2. Creep Damage. 3. Creep-Fatigue interaction curve for materials (selected for vulnerable locations) for which fatigue and creep damage have been computed along with the reference used for creep fatigue interaction curve. 4. The combined creep fatigue damage shall lie within acceptable limits. 5. Material data used for determining the fatigue and creep damage. 6. Code used for determining fatigue and creep along with details of its validation. 7. Details of specific changes in design to accommodate the defined load cycling	These documents are of proprietary information of OEM and cannot be furnished.	Bidder requested to consider the deviation.
91	VI / B	A-3	3 of 92	1.01.02 (g)	Extent and duration of permissible variations in rated steam temperature shall be same as specified for rated steam temperature upto 566 deg C in IEC-45 even though rated steam temperature exceeds 566 deg C.	Bidder is offering proven turbine modules designed with temperature / pressure variations as per OEM guidelines. Increasing these limits to IEC-45 limits (valid upto 566 °C) shall call for redesign of modules, which is not feasible. Allowable Temperature Variation as per OEM guideline shall be as under : + 4 °C duration not limited (*) + 10 °C for a maximum of 400 hrs / annum (*) + 24 °C for a maximum of 80 hrs / annum, single event limited to 15 min (*) (*) subject to that average steam temperature over any 12 months of operation is not exceeded the rated temperature for Main Steam & Reheat Steam.	Bidder requested to consider the deviation.
92	VI / B	A-3	9 of 92	1.05.00 (d)	Maximum permissible shaft vibration measured at bearing housing will be as per zone A of ISO 7919 and maximum permissible bearing vibration measured at bearing housing will be as per zone A of ISO 10816-2.	Maximum permissible shaft vibration and bearing housing will be as per Zone A/B +25% of ISO 7919 and Zone A/B+25% of ISO 10816-2 respectively.	Bidder agreed to withdraw the deviation
93	VI / B	A-3	9 of 92	1.05.00 (e)	Critical speed of composite rotor and blade assembly shall not be within - 10% and +15% of rated speed.	Collaborator's in house guidelines specify a margin of $\pm 10\%$ of rated speed or less with further conditions (e.g damping). Positive feedback from plants confirms this design approach.	Bidder requested to consider. the deviation

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94	VI / B	A-3	14 of 92	1.11.00 (f)	Provide Temporary & Permanent steam strainers for Emergency stop and Reheat Stop or control valves. In case there is no provision for temporary strainer, one set of strainers per unit shall be provided in addition to the permanent strainer. The strainers shall be arranged to permit easy inspection and cleaning	One common strainer is supplied for temporary & permanent use. Valve design for the offered steam turbine has integral strainers in Main Steam & HRH Valves as per specification requirement (VI / A / A-03, Cl 2.01.02). One set of additional strainers (4 No) is sufficient for the station.	Bidder agreed to withdraw the deviation
95	VI / B	A-3	15 of 92	1.12.01 (b)	NRV shall be suitable for on load testing and shall be provided with fail safe design.	Extraction NRVs are controlled through turbine control system. Online testing is not envisaged as per OEM practice. However, on load testing of Cold Reheat Non-return valve shall be carried out as part of ATT.	Bidder agreed to withdraw the deviation
96	VI / B	A-3	15 of 92	1.13.00	Insulation of Steam Turbine	It is clarified that Thermal Insulation of Steam Turbine will be designed considering the following parameters: Ambient Temperature: 40°C Max. Surface Temp. : 60°C Emissivity of Cladding : 0.2 Wind Velocity : 0.5 m/s for inside and 0.25 m/s for outside the main plant building	Bidder agreed to withdraw the deviation
97	VI / B	A-3	16 of 92	1.13.00 (c)	The insulated portion of the steam turbines shall be covered with fabricated steel cover, provided with suitable anti-drumming and sound pressure attenuating material inside.	All parts of steam turbine are not covered with steel cover due to its contour. Wherever possible, aluminium cladding shall be provided as per collaborator standard practice.	Bidder agreed to withdraw the deviation
98	VI / B	A-3	17 of 92	1.15.00 (a)	Emergency Governor: (1) Bidder shall provide overspeed trip of the Unit at 110% of rated speed in case speed governor fails to limit the turbine overspeed. (2) The emergency governor resetting shall be as per manufacturer's standard practice. However, it shall meet the IEC-45 requirements for overspeed trip.	The turbine speed control is implemented in the steam turbine controller to prevent overspeed trip. Turbine over speed is covered by turbine over speed protection and not by an mechanical emergency governor. A 2003 Over speed protection device is integrated in the turbine controller. High Reliability electrical over speed trip circuit is envisaged in place of conventional centrifugal type emergency governors as per our standard practice of our collaborator.	Bidder requested to consider the deviation.
99	VI / B	A-3	17 of 92	1.15.00 (b)	Emergency Hand Trip: Bidder shall provide emergency local hand trip device to facilitate manual tripping of the unit alongwith facility to trip turbine from UCB.	Emergency push button is provided in HPSU. There is also provision of tripping from Control Room. Local panel is not applicable. Local trip push buttons for manual tripping will be provided.	Bidder agreed to withdraw the deviation
100	VI / B	A-3	19 of 92	1.18.00 (3)	1x100% each AC & DC jacking oil pumps (if applicable for bidder design)	2x100% AC Jacking oil pumps are envisaged.	Bidder agreed to withdraw the deviation
101	VI / B	A-3	24 of 92	1.19.00 (a)	Turbine control fluid system: Provide control fluid system for each unit consisting of : (4) Ensure surfaces of reservoir in contact with fluid to be stainless steel, with 2x100% vapour extraction fans (if required) alongwith access ladders, platforms railings and manholes with covers on reservoir etc.	Access ladders, platforms railings and manholes with covers on reservoir etc. are not envisaged.	Bidder agreed to withdraw the deviation.

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102	VI / B & VI / B	A-3 E-1	30 of 92 17 of 23	1.23.00 & 1.06.02 (f)	Type test(s) to be conducted: Life cycle test, meridional yield rupture test and squirm test on one each of following type of metallic expansion joints: i. Condenser neck (if applicable) ii. Cross-over pipe (largest size) iii. LPH extraction line (highest pressure and temperature) iv. LPT Gland bellows (if applicable)	Due to use of proven design, Type Test of Metallic Expansion Bellows used in steam turbine is not envisaged.	Bidder agreed to withdraw the deviation
103	VI / B	E-01	2 of 23 & 9 of 23	1.01.01 & 1.01.06	Hydro test of Turbine Casings & Valves: 4) Cast enclosure shall be subjected to a hydraulic pressure test based on established practice of manufacturer unless there is a geometrical constraint for doing hydro test. Bidder to furnish their practice in this regard for Employer's approval. f) Each valve body and bonnet shall be hydraulically tested at minimum 1.5 times the maximum working pressure after applying temperature corrections.	Hydro test of Turbine Casings & Valves shall be carried out as per manufacturer's standard practice, wherever applicable as per the Quality Plan.	Bidder agreed to withdraw the deviation.
104	VI / G	Module-I	--	--	Steam Turbine : TECHNICAL DATA SHEETS	The data / information which are needed for operation & maintenance of the TG set shall be furnished during detailed engineering. The data which are properly in nature will not be furnished.	Required Data shall be furnished during Detail Engg. Bidder requested Employer to consider the deviation
105	VI/B	Pre-com & com	3 of 17	3.02.02	Turbine Generator Set Capability The steam turbine generator unit shall be capable of delivering at generator terminals the output as indicated by the bidder in the heat balance submitted along with his bid, under following condition. (a) Maximum continuous output at generator terminals corresponding to both strings of HP heaters out of operation, under rated steam conditions, at a specified ambient temperature and 3% make-up. NOTE: While conducting the test of (a) above the condense pressure measurement shall be done at 300 mm downstream LP	These tests will be done with available plant instruments subjected to availability of requested load & other parameters.	Bidder agreed to withdraw the deviation

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106	VI/B	Pre-com & com	3 of 17	3.02.03	(i) H.P./L.P. Bypass Capabilities The HP & LP Bypass system should satisfy the following functional requirements under automatic interlock action. It should come into operation automatically under the following conditions: (a) Generator circuit breaker opening. (b) HP - IP stop valves closing due to turbine tripping. (c) Sudden reduction in demand to house load. Under all these conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the		These tests will be done only if NTPC is able to provide required conditions during commissioning.	Bidder agreed to withdraw the deviation
107	VI / A	Functional Guarantees & Liquidated Damages	18/19 of 20	2.02.03	Corrections to the test results for steam "When the system is properly isolated for a performance test, the unaccounted for leakages should not be more than 0.1% of the design throttle flow at that load. To achieve the above value of unaccounted for leakage, the bidder shall prepare the unit before start of initial operation." "However during the test, if it is found that the unaccounted for leakage is more than 0.1% of design throttle flow at that load,.....leakage expressed as percentage of design throttle flow at that load and 0.1% (allowed by the code)."		"When the system is properly isolated for a performance test, the unaccounted for the leakage shall not exceed 0.3% of test throttle flow at that Load." "However, during the test, if it is found that the unaccounted for leakage is more than 0.3% of design throttle flow at that load, then heat rate will be increased by an amount equal to half the difference between actual unaccounted for leakage expressed as percentage of design throttle flow at that load and 0.3% ".	Bidder requested to consider the deviation.
108	VI / A	Functional Guarantees & Liquidated Damages	19 of 20	2.02.04	The performance guarantee test will be carried..... In calculating the above factor any period(s) during which the turbine has not been in operation at a stretch for more than a week shall not be considered.		Aging is a physical phenomenon and once steam enters into the cycle the aging of the components start. This is irrespective of whether the machine is in operation or not. Hence the aging period will be considered from the date of first synchronization to the conductance of PG test without any exclusion. Hence last para to be deleted.	Bidder requested to consider the deviation.
109	VI / B	A-3	29 of 92	1.22.01	Note: Any additional heat balances deemed necessary by the employer shall be furnished.		Since generation of HBDs at different conditions involves detailed calculations. The same needs to be performed at one go. Therefore, HBDs for new conditions cannot be done repeatedly. Hence List of HBDs should be finalized within 3 months of signing contract and later request cannot be complied with.	Bidder agreed to withdraw the deviation.
110	VI / A		2 of 20	1.00.01	(i) The performance..... Preliminary test reports shall be submitted to the Employer after completing each test run.		Bidder shall submit preliminary test data to the Employer after completing each set of test.	Bidder agreed to withdraw the deviation
111	VI/B	A-3	30 of 92	1.22.06	Furnish Turbine clearance diagram indicating values for radial & axial clearances and leakage rate from glands.		Turbine clearance diagram indicating values for radial & axial clearances and leakage rate from glands will be furnished for design condition only.	Bidder agreed to withdraw the deviation

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112	VI / B	A-3	30 of 92	1.22.03	(h) Variation in power factor, frequency, generator hydrogen pressure and voltage.		Hydrogen pressure is maintained constant during operation to ensure operational safety of generator. Hence the correction for generator hydrogen pressure is not applicable.	Bidder agreed to withdraw the deviation
113	VI/B	A-01	1 of 3	1.02.00 (c)	Operate continuously with HP heaters out of service with maximum specified cooling water temperature, 3% cycle make up and normal auxiliary steam requirement being tapped from cold reheat line, to generate maximum output without over stressing turbine components.		Steam parameters at exhaust of turbine casings are selected based on Turbine cycle parameters conceived by employer. Variation in these exhaust parameters is governed by limits of excursions permitted by OEM design/ IEC/ other design codes. Hence, to ensure safety of HP Turbine module, it can operate continuously with HP heaters out of service subject to HP exhaust pressure remaining within allowable limits.	Bidder agreed to withdraw the deviation
114	VI/G	TDS/ DA2(II)	47 of 137	4.01.15	i) Design back end loading T/hr-m2 ii) Back end loading under following conditions T/hr-m2 a) EMCR b) VWO c) VWO + over pressure . d) HP heaters out		As per cl 1.06.00 (h)/sec-VI/Part-B of chapter Steam turbine and auxiliaries, back end loading under V.W.O. condition not to exceed 90% of design stress value. Accordingly, back end loading will be furnished for these two load cases only to substantiate the design margins.	Bidder agreed to withdraw the deviation
	VI/B	A-3	9 of 92	1.06.00 (h)	Ensure stress induced in LPT blading due to back end steam loading under V.W.O. conditions not to exceed 90% of design stress value.			
115	VI/G	TDS/ DA2(II)	13 of 137	2.34.07	Gland leakage coefficients a) Stop and control valves b) HP front c) HP rear d) Reheat stop & control valve e) IP front f) IP rear		Such data requested in data sheets is proprietary in nature, hence cannot be furnished.	Bidder requested to consider the deviation.

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116	VI/G	TDS/ DA2(II)	12 of 137	2.34.06	Pressure drops..... i) Extraction lines to HPH-5A & i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet j) Extraction line to deaerator i) From stage outlet to turbine flange. ii) From turbine flange to deaerator inlet k) Extraction line to LPH-3 i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet l) Extraction line to LPP-2 i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet m) Extraction line to LP Heater(s) & Condenser neck i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet		The data which is proprietary in nature cannot be furnished. Hence Pressure drop values will be furnished for selected items as below:- Pressure drops..... i) Extraction lines to HPH-5A & i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet j) Extraction line to deaerator i) From stage outlet to turbine flange. ii) From turbine flange to deaerator inlet k) Extraction line to LPH-3 i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet l) Extraction line to LPP-2 i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet m) Extraction line to LP Heater(s) & Condenser neck i) From stage outlet to turbine flange. ii) From turbine flange to heater inlet	Bidder agreed to withdraw the deviation.
117	VI/G	TDS/ DA2(I)	6 of 30	1.01.02	The expansion lines are to be furnished for the following operating conditions: i) 660 MW output under rated steam conditions at condenser pressure of 77 mm Hg (abs) & 0% make up		In line with cl no.1.22.04 /Sec-VI/ Part B of chapter steam turbine and auxiliaries system, Turbine expansion line diagrams are to be furnished for Guaranteed load points. Hence, Turbine expansion line diagrams will be generated for guaranteed load points only.	Bidder agreed to withdraw the deviation.
118	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.		HBDs will be generated in line with cl no.1.22.01/Sec-VI/ Part B of chapter steam turbine and auxiliaries system in tender specification. (i.e. HBD at 65% unit rated output under modified sliding pressure operation at condenser pressure of 77 mm Hg (abs) with 0% and 3% make up is not applicable).	Bidder requested to consider the deviation.
119	VI / B	A-3	10 of 92	1.06.01- a (1)	The On-line integrated system shall consist of suitable number of Non-contact eddy current / inductive / magnetic sensors, including hardware, software for monitoring blade vibrations and health based on, but not confined only to blade vibration amplitude / frequency, for last stage and/or last but one stage free standing blades (both Turbine end & Generator end) of low pressure turbines.		1. Bidder can provide a blade vibration measurement of the last stage LP-Turbine rotating blades. A health monitoring / crack detection system can not be provided. 2. Only L-0 (last stage blades) (both Turbine & Generator end) stages, which is free standing of LP Steam Turbines shall be monitored. 3. Last but one stage blades are shrouded and therefore need not be monitored.	Bidder agreed to withdraw the deviation.

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120	VI / B	A-3	10 of 92	1.06.01-a (4)	The system should be helpful in identifying the individual blade having crack, prior to failure of blade (off-line analysis/assessment).	Bidder can provide a blade vibration measurement of the laststage LP-Turbine rotating blades. A health monitoring / crack detection system can not be provided.	Bidder agreed to withdraw the deviation
121	VI / B	A-3	10 of 92	1.06.01-a (7)	Generation of reports on a schedule (preferably automatic) in minimum one week and reports to be sent to specified recipients via email.	Automatic report generation shall be included. However blade health report shall be provided monthly. Vibration data can be extracted from system weekly or as and when required. Broadband connection with static IP shall be provided by customer for automatic emailing.	Bidder agreed to withdraw the deviation
122	VI / B	A-3	10 of 92	1.06.01-a (9)	Importing plant process data (minimum 16 nos.) from OPC server, and displaying side-by-side with blade vibration data. In case this is not possible, the data shall be acquired through hardwiring using F type instrumentation cables from control cabinets located in Control Equipment Room.	Plant data (16 nos. only) shall be imported using hardwiring through F-type cables and not OPC server.	Bidder agreed to withdraw the deviation
123	VI / B	A-3	10 of 92	1.06.01-a (10)	To generate advisory report remotely, at least once a week and in case of change in behaviour/vibration pattern as per requirement., for the purpose of health assessment of blading and send report by email to NTPC, for a period not less than one (1) year from the date of commissioning of the integrated system.	Automatic report generation shall be included. However blade health report shall be provided monthly. Vibration data can be extracted from system weekly or as and when required. Broadband connection with static IP shall be provided by customer for automatic emailing.	Bidder agreed to withdraw the deviation
124	VI / B	A-3	11 of 92	1.06.01-a (16)	It shall be possible to transfer major data over soft link to third party systems e.g. OSI/PI etc.	Linking of system to third party systems (through soft or hard link) shall not be included due to IPR restrictions.	Bidder agreed to withdraw the deviation
125	VI / B	A-3	11 of 92	1.06.01-a (17)	System/Software should have Multi-user license including for Remote location.	It is a single user license system. Simultaneous analysis of running data at site as well as other location shall not be possible.	Bidder agreed to withdraw the deviation
126	VI / B	A-3	11 of 92	1.06.01-a (21)	Bidder shall provide the required training to at least six (6) Employer persons on working of the system, operation and maintenance, data analysis, interpretation towards health monitoring of blades and troubleshooting of the system.	3 days on-site training shall be provided to one batch of engineers.	Bidder agreed to withdraw the deviation
127	VI / B	MDL	—	—	Master Drawing List (MDL)	MDL will be finalised during detailed engineering.	Bidder agreed to withdraw the deviation
128	VI / A	Terminal Points	9 of 10	12.10.00	At interface points counter flanges ,fittings , matching pieces etc. where required shall be supplied by the TG Contractor.	At interface points counter flanges ,fittings , matching pieces etc. where required shall be supplied by the SG Contractor.	Bidder agreed to withdraw the deviation
129	VI / B	A-03. Amnd-04, SI-2	3 of 92	1.01.03 (a)	OLV operation shall also be envisaged for entire range of plant operation to meet the instantaneous increase in load demand.	OLV operation is envisaged for instantaneous increase in load demand only after HP Main valve wide open.	Bidder agreed to withdraw the deviation.

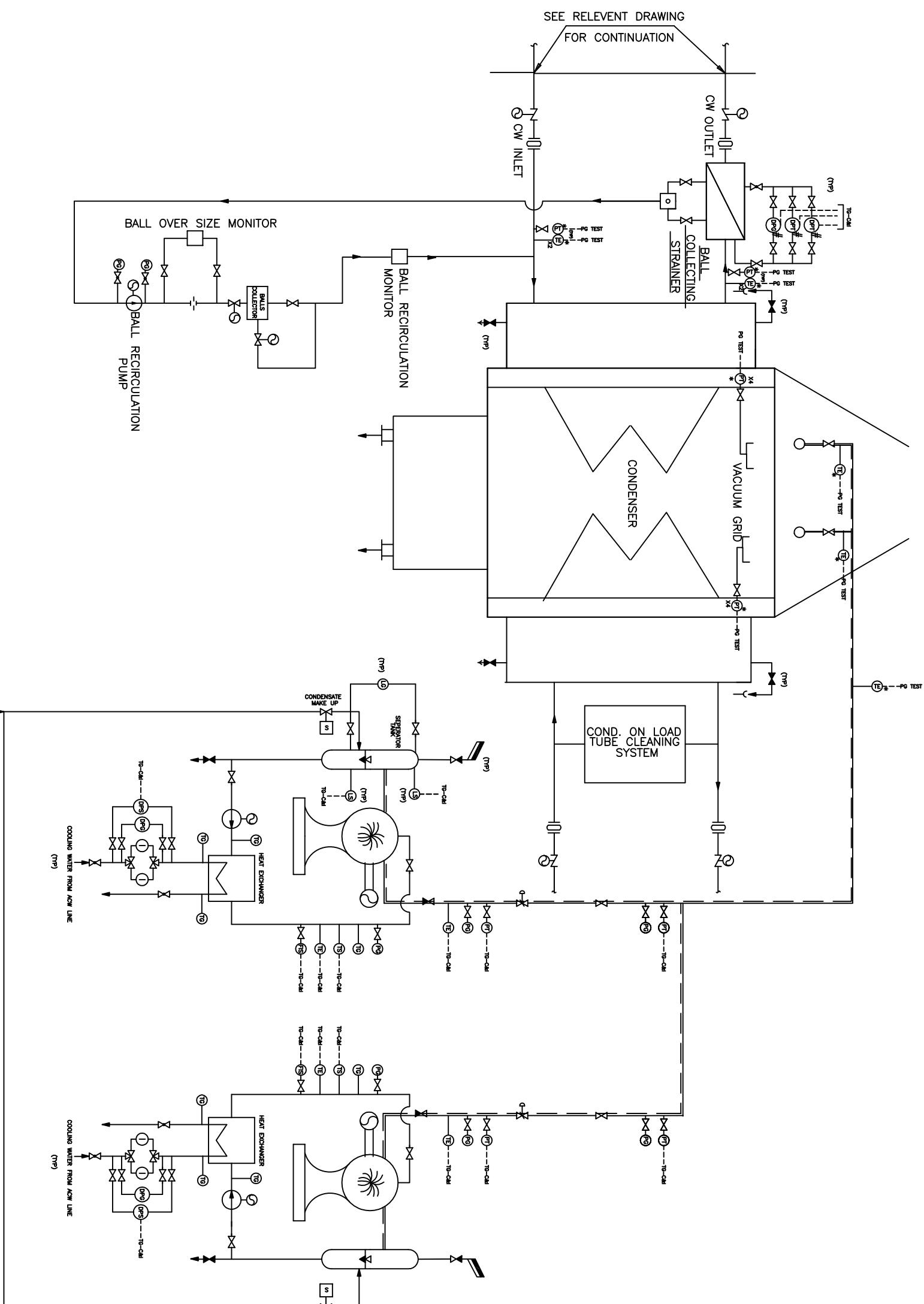
KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT	DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
130	VI / B	A-03	5 of 92	1.01.04 (vi)	Plant shall be designed to give life of not less than 25 years. Further, expected numbers of Steam Turbine Generator start ups during design life are as follows: Hot Start - 4000, Warm start - 1000, Cold Start - 150. VI / B / A-03 / 24 of 52, 1.21.00 (a) : The steam turbine Generator set apart from being capable of operation on base load shall also be suitable for two shift operation and cyclic load variations as the unit is expected to operate in automatic load frequency control system. VI / B / A-01 / 1 of 3, 1.02.00 (a) : Operate continuously with turbine under VWO condition with rated steam parameters, specified rated condenser pressure and 3% cycle make up. VI / B / A-01 / 1 of 3, 1.02.00 (a) : Operate continuously with HP heaters out of service with maximum specified cooling water temperature, 3% cycle make up VI / B / A-01 / 2 of 3, 1.02.00 (i) : The unit shall be capable of increasing the load by activating the condensate throttling, to meet the load fluctuations (whenever required). VI / B / A-01 / 2 of 3, 1.04.00 : The plant shall be	Owner to specify the design conditions for Steam Turbine Generator. The design conditions and operational capabilities are contradictory	Bidder agreed to withdraw the deviation
	VI / B	A-01 & 03					
	VI / B	A-01 & 03					
131	VI / B	A-3	32 of 92	2.01.00 (i)	Water box, tube plates and support plates material carbon steel as per ASTMA-285 Gr.C or ASTM A-516 GR 70 and suitable for intended duty.	Water box, support plate and Tube plate material shall also be inline with shell and hotwell i.e. ASTM A 285 Gr. C/ IS 2062 Gr. BR or equivalent. BHEL has been using above specified in all the 660MW/700MW/800MW sets supplied to various utilities. Further, it is confirmed that the material offered is equivalent to the material specified and is suitable for intended purpose.	Bidder requested Employer to consider the Deviation
132	VI / B	A-3	31 of 92	2.00.00 (h)	Max. oxygen content of condensate leaving the condenser shall be 0.015 CC per litre over the entire load range.	For supercritical projects, oxygen is dosed in the condensate system to prevent the corrosion of the piping and fittings. Hence, limiting of oxygen content to 0.015cc/l at hotwell outlet is not required. This is in-line with the practice adopted for other 660/ 800 MW supercritical projects and is an internationally accepted practice.	Bidder agreed to withdraw the deviation
	VI / B	Pre Com. & Com.	4 of 17	3.02.03(ii)(b)	Oxygen content in condensate, at hotwell outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method.		

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL								
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
133	VI / B	E-1	14 of 23	1.05.0.3	Dished ends shall be subjected to 100% MPI and RT/UT on welded joints.Knuckle portion shall be checked by MPI for surface defects and thinning shall be checked by UT.		UT shall be done on Plates before forming to Dished End. UT on curved surface of dished end is not advisable due to inaccuracies involved. MPI/DPT shall be performed on dished ends after forming.	Bidder agreed to withdraw the deviation.
	VI / B	E-04	2 of 3	2.00.00 (5)	Dished ends shall be subjected to 100% MPI and RT/UT on welded joints.Knuckle portion shall be checked by MPI for surface defects and thinning shall be checked by UT.			
134	VI / B	E-04	3 of 3	3.00.00 (Remarks)	For HP Heater & Gland steam coolers the statutory requirements as per IBR to be ensured and the certificates in original to be furnished as per IBR statutory requirements		GSC shall be tested as per ASME Sec VIII- Div-1. As IBR is not applicable for low pressure cycle in power plant, GSC shall be tested as per applicable provisions of ASME Sec VIII Div-	Bidder agreed to withdrae the deviation.
135	VI / B	B-01	10 of 40	6.00.00 - 15 - (E) VIBRATION MONITORING SYSTEM	At least six (6) numbers of dual axis optical System sensor type vibration pickups at each end of over hang portion of the winding shall be provided, symmetrically located around the periphery with connection to Turbine Supervisory system for vibration monitoring and trend recording.		As Generator winding bars are tightly fitted / bounded with each other and further suitable support has been provide to these bars. Hence very less vibration seen in tangent direction and vibration always seen in radial direction only. Hence as per OEM standard practice, eight single axis optical sensor are envisaged (instead of six dual axis) for measuring radial vibration only	Bidder agreed to withdraw deviation and comply with technical specification requirement.
136	VI / B	B-01	13 of 40	7.00.00-13 GAS SYSTEM	The local Generator auxiliary panel (located at 0.0m) shall be complete with all lamps, indicators, power supplies etc.		The Generator Gas system / Seal oil system / stator water cooling system interface directly with TG-C&I system which allows remote monitoring and control of the generator auxiliary systems. All other indications / Alarms are provided on MMI. Hence, a common local generator aux. panel (one no.) is envisaged for Generator Gas system/ Seal oil system / stator water cooling system (at 0.0 meter) for standard local	Bidder agreed to withdraw deviation and comply with technical specification requirement.
			16 of 40	8.00.00 - (n) SEAL OIL SYSTEM	The system shall be controlled as part of turbine control system at CCR. The local Generator auxiliary panel (located at 0.0m) shall be complete with all lamps, indicators, power supplies.			
			19 of 40	9.03.00	The local Generator auxiliary panel (located at			
137	VI / B	IIIC-02B	2 of 4	1.02.00	All trip signal inputs required for the safety of the turbine shall be generally based on 2 out of 3 logics.		The bearing pedestal vibration protection will be realized through a '2 out of 2' logic, while all the remaining protection circuits are implemented in 2 out of 3 logic. This is as per OEM philosophy.	Bidder agreed to withdraw the deviation
138	VI / B	IIIC-03	1 of 5	2.01.01	(a) Shaft eccentricity detection. (c) Differential expansion of rotor and cylinder for HPT, IPT and LPT. (D) Overall expansion of HPT and IPT. (E) Bearing vibration measurement of each bearing in both X & Y directions (both for turbine and generator bearings). (I) Computed absolute shaft vibration from b) and e) above.		(a) At low speeds, shaft vibration is an indication of eccentricity. Separate eccentricity probe is therefore not provided (c) & (D) Differential & over all expansion of HPT & second LPT is envisaged as per OEM standard practice. e) Bearing vibration will be measured in either XX or YY direction. This is as per OEM practice.	Bidder agreed to withdraw the deviation

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL							
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT	DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.			
139	VI/B	E-01	2 of 23	1.01.01 (4)	High Pressure & Intermediate Enclosure: Bidder to furnish their practice in this regard for Employer's approval.	BHEL's procedure is proven and has been used successfully in all NTPC projects. Hence owner's approval is not envisaged. However, these can be referred by the inspecting authority during inspection.	Bidder agreed to withdraw the deviation.
			3 of 23	1.01.02 (b)	Low Pressure Enclosure (Fabricated) Bidder to furnish their practice regarding stress relieving of the fabricated enclosures for Employer's approval.		
			3 of 23	1.01.02 (c)	Low Pressure Enclosure (Fabricated) Bidder to furnish their standard practice regarding NDT on welds for Employer's approval		
			3 of 23	1.01.02 (d)	Low Pressure Enclosure (Fabricated) Bidder to furnish his proven practice for hydraulic pressure tests. If it is not their practice, the justification for not carrying out hydraulic test shall be furnished for Employer's approval.		
140	VI/C	GTR	34 of 89	9.02.04	General Technical Requirements The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.	BHEL Haridwar has its own well established standards & procedures. These being proprietary in nature, cannot be submitted for owner approval. However these can be referred by the inspecting authority during inspection.	Bidder agreed to withdraw the deviation.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES Bid Document No.: THDC/RKSH/CC-9915-371, Bidder: BHEL								
SL. NO.	ENQUIRY SPECIFICATION				TENDER SPECIFICATION REQUIREMENT		DESCRIPTION OF COMMENTS/ DEVIATIONS	Final Position of the Bidder
	SECTION /PART	BOOK/ SUB-SEC.	PAGE NO.	CLAUSE NO.				
141	VI/C	GTR	34 of 89	9.02.04	General Technical Requirements All deviations to this specification, approved quality plans and appli-cable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.		For BHEL supplied equipment's: Deviations are classified as:- Critical: Defects which will be cause operating troubles difficult to correct at site, will render equipment irrepa-rable and unfit for use, made it liable to case injury or physical damage under normal use. These are not acceptable for further processing. Major: Defects other than critical, which may affect maintenance, erection, interchangeability and operat-ing life. Major deviations shall be referred to the customer for their review & acceptance. Minor: Defects other than critical and major defects which will not in any way affect operations, mainte-nance, life of equipment, minor defects in appearance, finish or workmanship and minor non-functional defects These will be submitted to the Resident Inspector for information & record.	Bidder agreed to withdraw the deviation.
142	VI/C	GTR	37 of 89	9.02.22	General Technical Requirements Repair/rectification procedures to be adopted to make the job ac-ceptable shall be subject to the		Weld repairs on cast parts are only allowed to be carried out by qualified welders applying qualified processes and materials. Such	Bidder agreed to withdraw the deviation.

AMEDMENTS TO SPECIFICATION

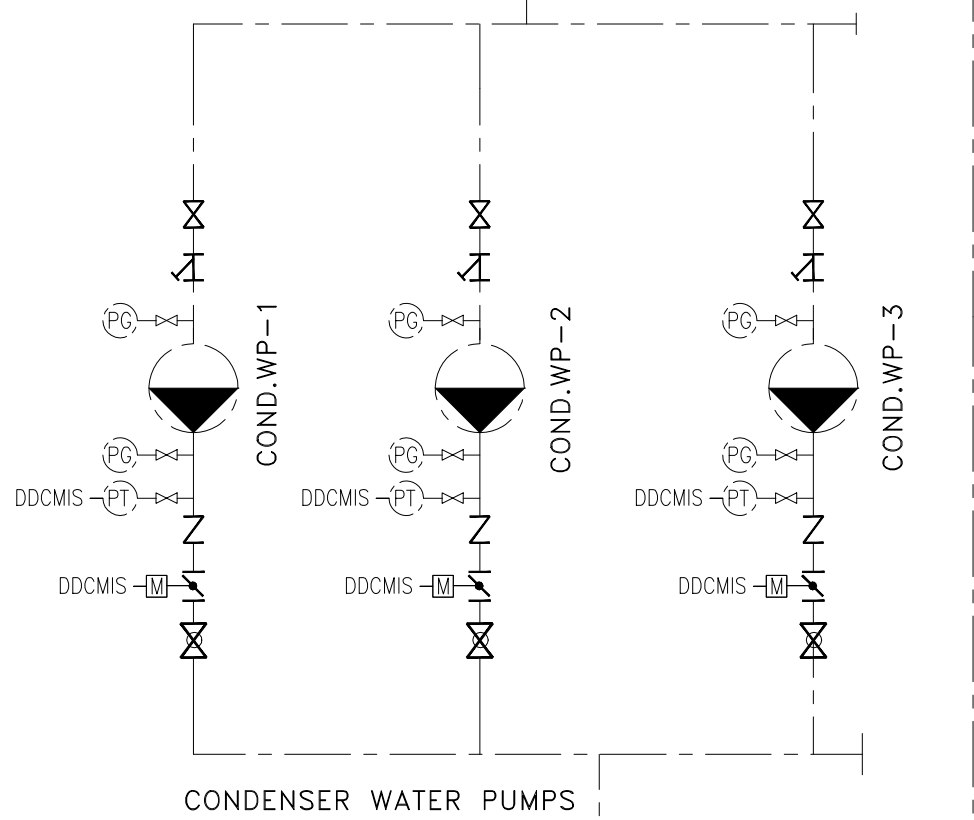
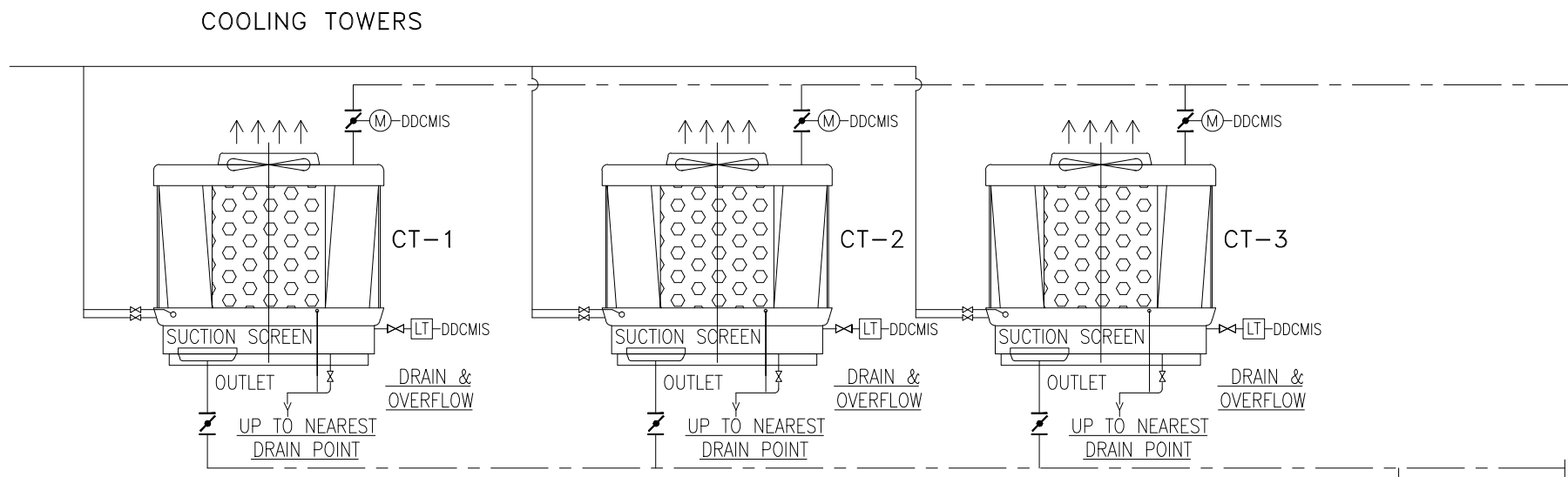
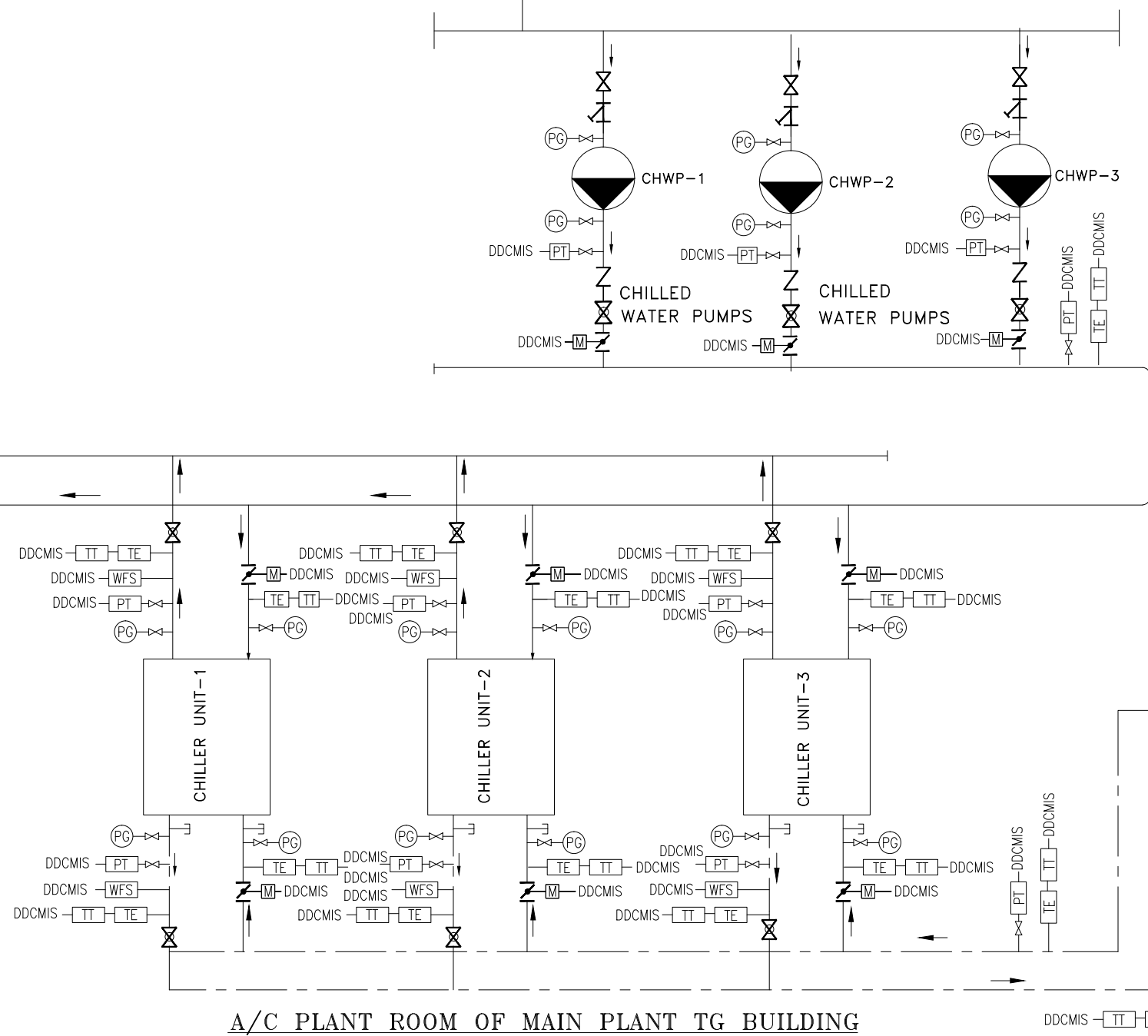
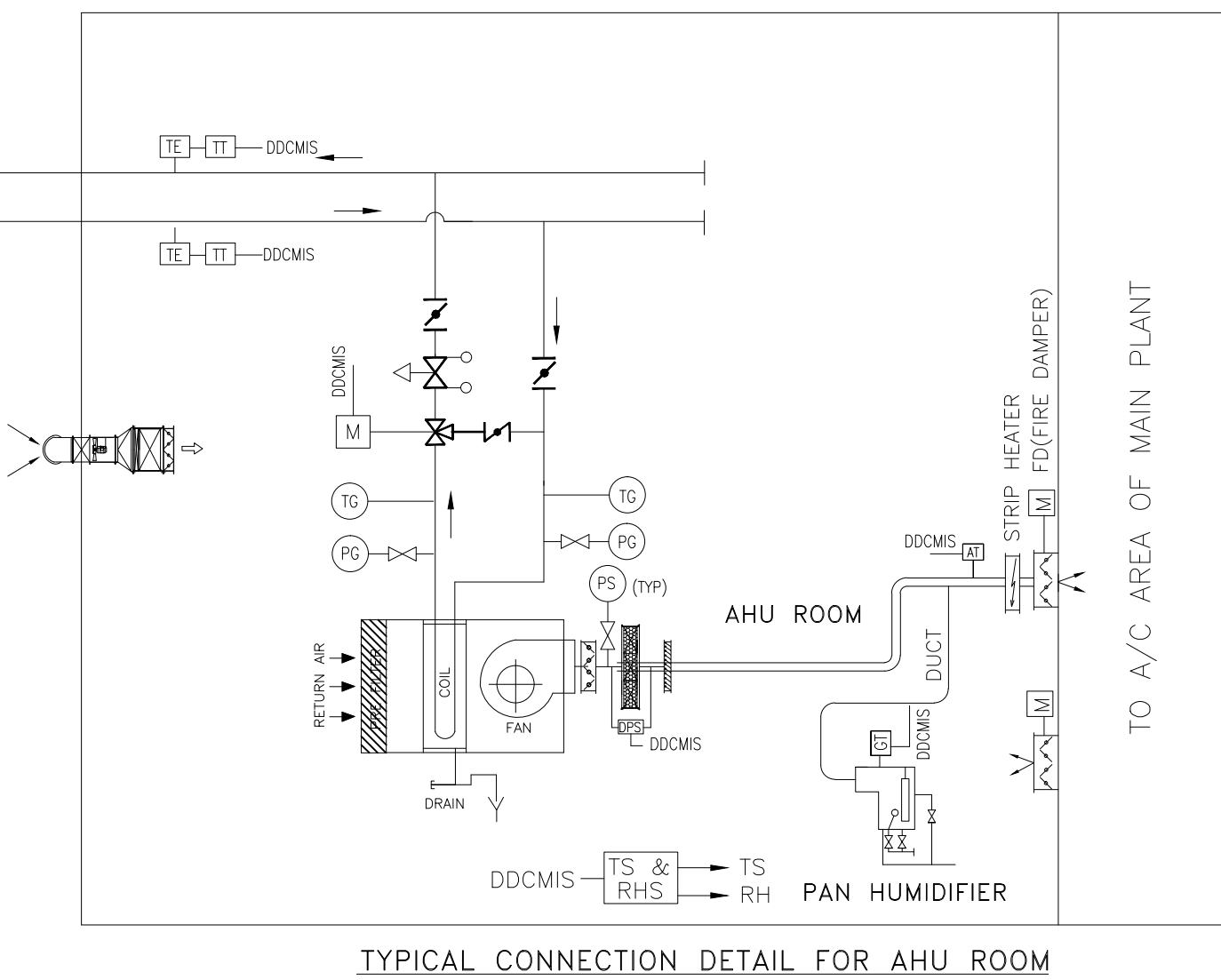
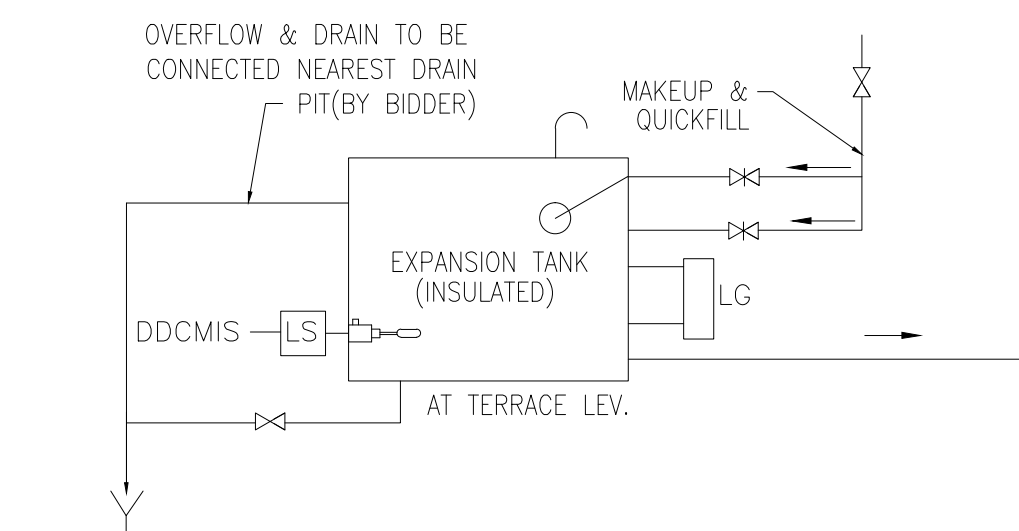


LEGEND	
SYMBOL	DESCRIPTION
	DUPLEX STRAINER
	PNEUMATICALLY OPERATED
	SOLENOID OPERATED
	ELECTRICAL DRIVE
	BUTTERFLY VALVE
	CENTRIFUGAL PUMP
	EXPANSION JOINT
	VENT TO ATMOSPHERE TO BE SUITABLY LED OUTSIDE THE BUILDING.
	ISOLATING VALVE
	ORIFICE
	NON RETURN VALVE
	THREE WAY VALVE

NOTES

1. THE DRAWING IS INDICATIVE AND DOES NOT DEFINE THE FULL EXTENT OF SUPPLY.
2. ALL VALVES SUBJECTED TO VACUUM SHALL BE PROVIDED WITH PROPER GLAND SEALING ARRANGEMENT.
3. ALL EQUIPMENT AND PIPING SHALL BE PROVIDED WITH PROPER DRAINAGE AND VENTING ARRANGEMENT. THE DRAINS SHALL BE LED TO THE NEAREST AVAILABLE DRAIN HEADER BY THE SUPPLIER AND THE VENTS SHALL BE SUITABLY LED TO OUTSIDE THE MAIN PLANT BUILDING.
4. ALL THE INSTRUMENT SHALL BE IN THE SCOPE OF BIDDER. THE MEASURING INSTRUMENTS INDICATED IN THE TENDER PID ARE MINIMUM THAT ARE REQUIRED TO BE PROVIDED BY THE BIDDER. IN CASE ADDITIONAL INSTRUMENTS ARE REQUIRED AS PER THE STANDARD & PROVEN PRACTICE OF THE BIDDER/SUB-VENDOR, THE SAME SHALL BE SUPPLIED WITHIN THIS CONTRACT.
5. DETAILS OF CONDENSER ON LOAD TUBE CLEANING SYSTEM IS SHOWN FOR ONE HALF OF DIVIDED WATER BOX CONDENSER.
6. # THESE SHALL BE REMOTE SEAL TYPE.
7. DEWATERING PUMP SHALL BE PROVIDED FOR CW PIT.
8. THE DRAWING IS TYPICAL. NO. OF CONDENSER SHALL BE AS PER SPECIFICATION.
9. THE BALL COLLECTION SYSTEM SHOWN ARE INDICATIVE. BIDDER MAY OFFER THE SYSTEM AS PER THEIR PROVEN PRACTICE MEETING INTENT AND OBJECTIVE OF SPECIFICATION AND PROCESS.

[illegible]



CHILLED WATER PUMP DETAIL	
NAME	QTY
CHWP-1 TO 3	3 NOS(2W+1S/B)

CONDENSER WATER PUMP DETAIL	
NAME	QTY
COND.WP-1 TO 3	3 NOS(2W+1S/B)

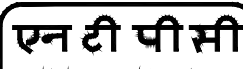
COOLING TOWER DETAILS	
NAME	QTY
CT-1 TO 3	3 NOS(2W+1S/B)

	TEMPERATURE TRANSMITTER)
	CH.WATER SUPPLY & RETURN PIPE
	COND.WATER SUPPLY & RETURN PIPE
	OPEN DRAIN PIT
	ATMOSPHERIC VENT
	DESCALING CONNECTION
	STRIP HEATER
	FRESH AIR FAN WITH PRE FILTER & FINE FILTER
	CENTRIFUGAL FAN
	PUMP
	PAN HUMIDIFIER
	TEMPERATURE GAUGE
	LEVEL GAUGE
	LEVEL TRANSMITTER
	LEVEL SWITCH
	GEYSER STAT
	AIR STAT
	DIFFERENTIAL PRESSURE SWITCH
	WATER FLOW SWITCH
	RH SENSOR &TEMP.SENSOR
	TEMPERATURE ELEMENT(SENSOR)
	PRESSURE TRANSMITTER
	PRESSORE GAUGE
	HEPA FILTER
	FINE FILTER
	PRE FILTER
	ML TYPE FIRE DAMPER(MOTORISED)
	VOLUME CONTROL DAMPER (ML TYPE)
	NON RETURN DAMPER (ML TYPE)
	FLOW CONTROL VALVE
	GATE VALVE
	FLOAT VALVE
	MOTORIZED GLOBE VALVE(INCHING TYPE)
	BALANCING VALVE
	3 WAY VALVE (MODULATING WITH ACTUATOR)
	GLOBE VALVE
	CHECK VALVE
	'Y' STRAINER
	BUTTERFLY VALVE(MOTORISED)
	BUTTERFLY VALVE
LEGEND	DESCRIPTION

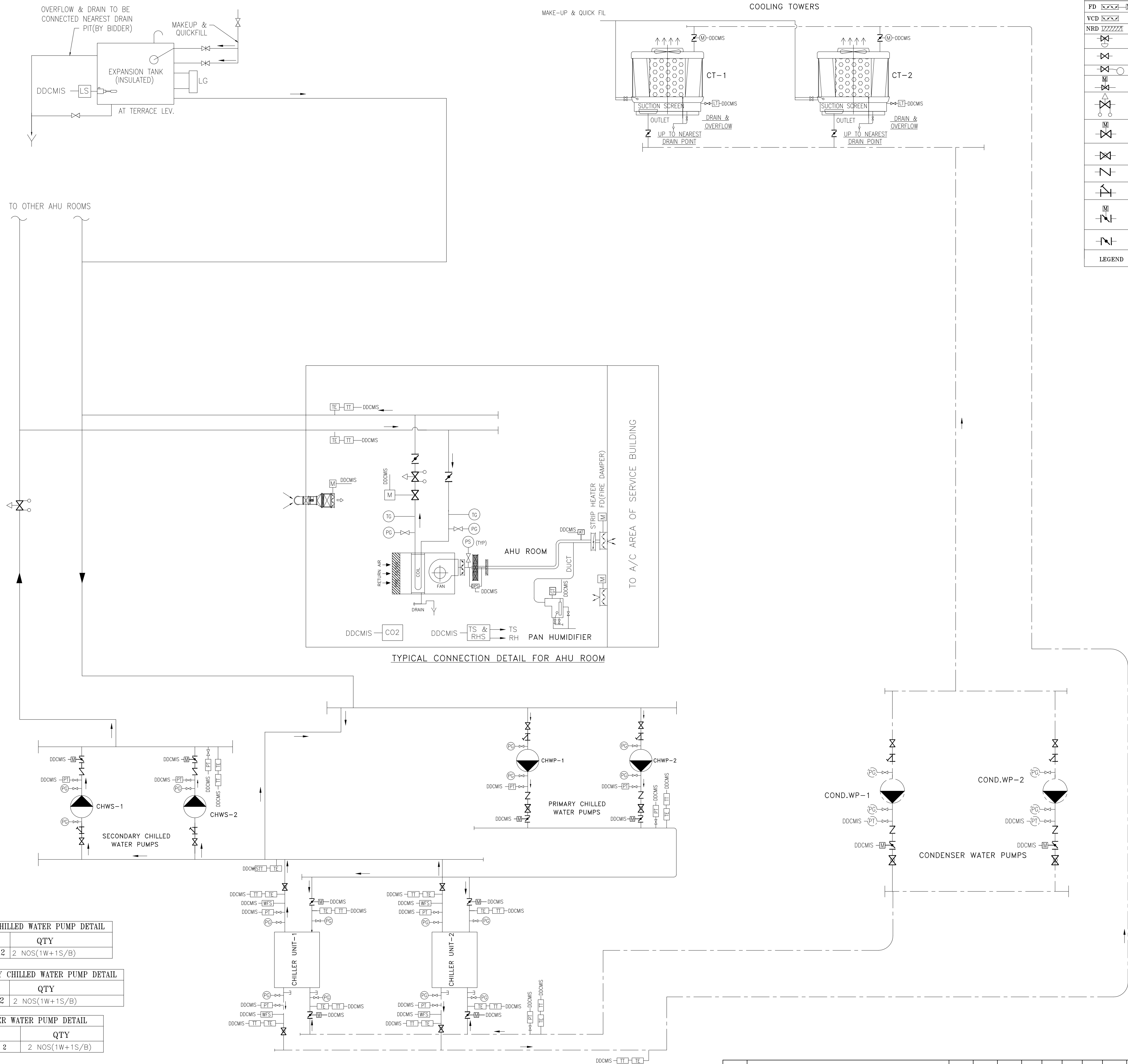
NOTE:

- 1) CAPACITY OF ALL THE A/C EQUIPMENTS SHALL BE FINALISED DURING DETAILED ENGINEERING.
- 2) SIZE OF PIPES, VALVES ETC SHALL BE FINALISED DURING DETAILED ENGINEERING
- 3) NUMBER OF AHU AND AHU CAPACITY SHALL BE FINALISED DURING DETAILED ENGINEERING
- 4) CHILLED WATER PUMPS, PIPING, VALVES, EXPANSION TANK, AHU-DRAIN ETC. SHALL BE INSULATED AS PER SPECIFICATION.
- 5) ALL PIPING & VALVES OF SIZE 40 NB & BELOW SHALL BE PROVIDED AS PER SYSTEM REQUIREMENT BY THE BIDDER.
- 6) FOR FLOW BALANCING, BALANCING VALVE AND ORIFICE PLATE SHALL BE PROVIDED BY BIDDER AS PER SYSTEM REQUIREMENT.
- 7) 1X100% CAPACITY FRESH AIR FAN SHALL BE PROVIDED IN EACH AHU ROOM
- 8) TEMPERATURE SENSOR (TS) & RELATIVE HUMIDITY SENSOR (RHS) SHALL BE PROVIDED IN EACH AHU ROOM.
- 9) AIR RELEASE VALVES AS PER SYSTEM REQUIREMENT SHALL BE PROVIDED AT SUITABLE LOCATIONS.

FOR TENDER PURPOSE ONLY

CLIENT		 <i>THDC INDIA LIMITED</i> (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)	
CONSULTANT		 एन टी पी सी लिमिटेड <i>NTPC Limited</i> (A GOVT. OF INDIA ENTERPRISE) ENGINEERING DIVISION	
PROJECT		KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2x660MW)	
TITLE			
SCHEMATIC DIAGRAM FOR A/C SYSTEM FOR MAIN PLANT TG BUILDING			
SIZE	SCALE	DRG.NO.	REV.
A1	NTS	9915-002-POM-A-054	01

CAD FILE NAME : 9915-002-POM-A-054



	HEPA FILTER
	FINE FILTER
	PRE FILTER
FD  M	ML TYPE FIRE DAMPER(MOTORISED)
VCD 	VOLUME CONTROL DAMPER (ML TYPE)
NRD 	NON RETURN DAMPER (ML TYPE)
	FLOW CONTROL VALVE
	GATE VALVE
	FLOAT VALVE
	MOTORIZED GLOBE VALVE(INCHING TYPE)
	BALANCING VALVE
	2 WAY VALVE (MODULATING WITH ACTUATOR)
	GLOBE VALVE
	CHECK VALVE
	‘Y’ STRAINER
	BUTTERFLY VALVE(MOTORISED)
	BUTTERFLY VALVE
LEGEND	DESCRIPTION

	TEMPERATURE TRANSMITTER)
	CH.WATER SUPPLY & RETURN PIPE
	COND.WATER SUPPLY & RETURN PIPE
	OPEN DRAIN PIT
	ATMOSPHERIC VENT
	DESCALING CONNECTION
	STRIP HEATER
	FRESH AIR FAN WITH PRE FILTER & FINE FILTER
	CENTRIFUGAL FAN
	PUMP
	PAN HUMIDIFIER
	TEMPERATURE GAUGE
	LEVEL GAUGE
	LEVEL TRANSMITTER
	LEVEL SWITCH
	GEYSER STAT
	AIR STAT
	DIFFERENTIAL PRESSURE SWITCH
	WATER FLOW SWITCH
	RH SENSOR
	TEMP.SENSOR
	TEMPERATURE ELEMENT(SENSOR)
	PRESSURE TRANSMITTER
	PRESSURE GAUGE
LEGEND	DESCRIPTION

NOTE:

- 1) CAPACITY OF ALL THE A/C EQUIPMENTS SHALL BE FINALISED DURING DETAILED ENGINEERING BASED ON HEAT LOAD CALCULATION OF SERVICE BUILDING
- 2) SIZE OF PIPES, VALVES ETC SHALL BE FINALISED DURING DETAILED ENGINEERING
- 3) NUMBER OF AHU AND AHU CAPACITY SHALL BE FINALISED DURING DETAILED ENGINEERING BASED ON THE FINALISED ARCHITECTURAL DRAWING OF THE SERVICE BUILDING
- 4) VARIABLE AIR VOLUME BOX (VAV) SHALL BE PROVIDED FOR OPTIMUM USE OF AHU THROUGH VAVFD. NUMBERS OF VAV BOX SHALL BE FINALISED DURING DETAILED ENGINEERING. VAV BOX SHALL BE REGULATED BY TEMPERATURE SENSOR & OCCUPANCY SENSOR PROVIDED IN RESPECTIVE ROOMS.
- 5) SECONDARY CHILLED WATER PUMPS, COOLING TOWER FANS, AHU SHALL BE VVFD
- 6) CHILLED WATER PUMPS, PIPING, VALVES, EXPANSION TANK, AHU-DRAIN ETC. SHALL BE INSULATED AS PER SPECIFICATION.
- 7) ALL PIPING & VALVES OF SIZE 40 NB & BELOW SHALL BE PROVIDED AS PER SYSTEM REQUIREMENT BY THE BIDDER.
- 8) FOR FLOW BALANCING, BALANCING VALVE AND ORIFICE PLATE SHALL BE PROVIDED BY BIDDER AS PER SYSTEM REQUIREMENT.
- 9) TEMPERATURE SENSOR (TS) & RELATIVE HUMIDITY SENSOR (RHS) SHALL BE PROVIDED IN EACH AHU ROOM.
- 10) AIR RELEASE VALVES AS PER SYSTEM REQUIREMENT SHALL BE PROVIDED AT SUITABLE LOCATIONS.
- 11) ALL WATER PIPES SHALL BE AS PER TECHNICAL SPECIFICATION.

PRIMARY CHILLED WATER PUMP DETAIL	
NAME	QTY
CHWP-1 TO 2	2 NOS(1W+1S/B)

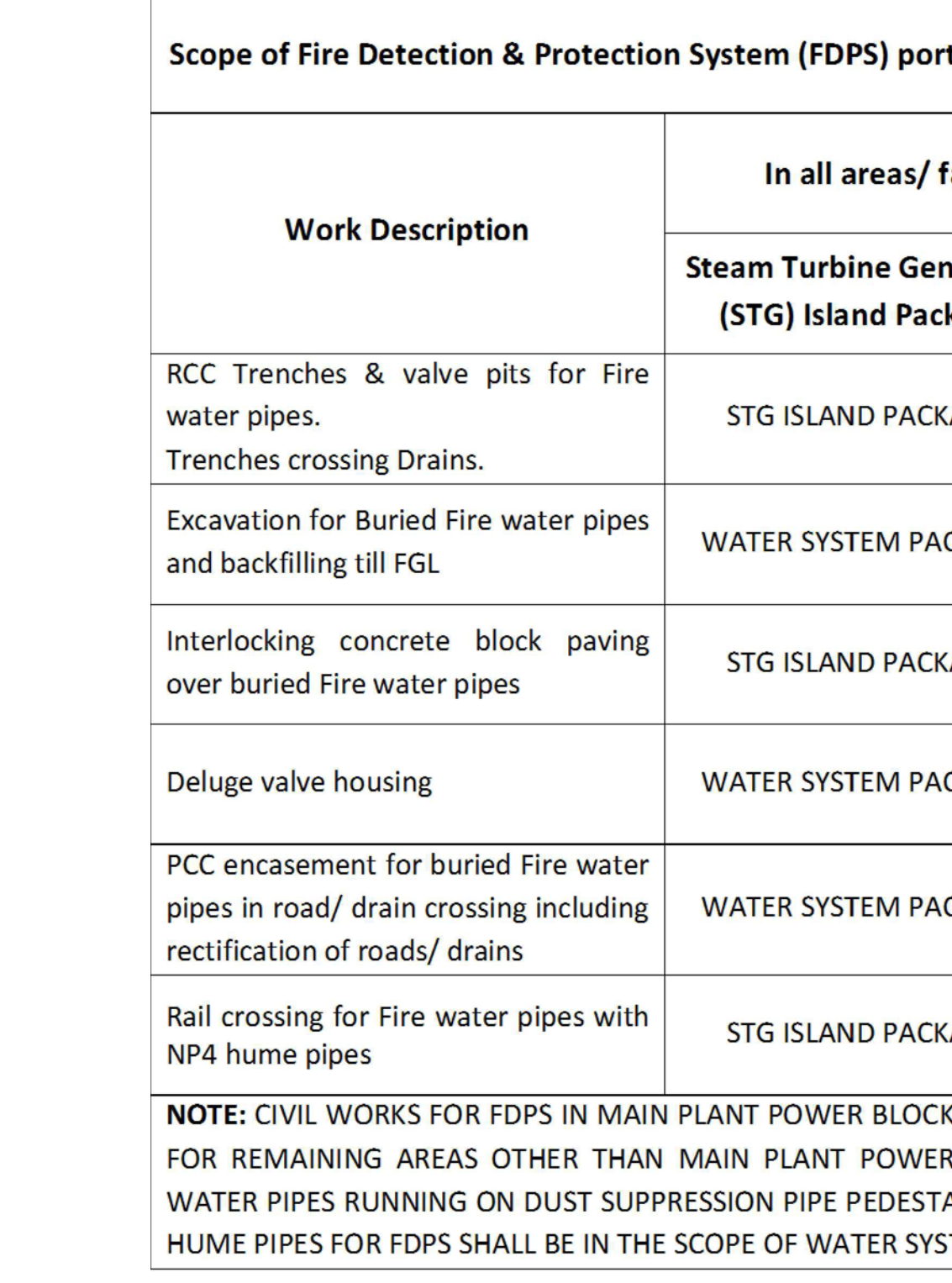
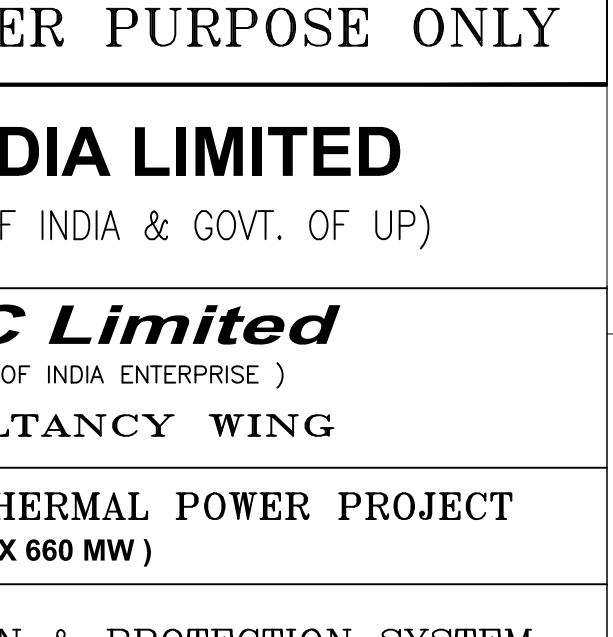
SECONDARY CHILLED WATER PUMP DETAIL	
NAME	QTY
CHWS-1 TO 2	2 NOS(1W+1S/B)

CONDENSER WATER PUMP DETAIL	
NAME	QTY
COND.WP-1 TO 2	2 NOS(1W+1S/B)

COOLING TOWER DETAILS	
NAME	QTY
CT-1 TO 2	2 NOS(1W+1S/B)

[illegible]

CLIENT	 THDC INDIA LIMITED (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)		
CONSULTANT	 एन टी सी लिमिटेड NTPC Limited (A GOVT. OF INDIA ENTERPRISE) ENGINEERING DIVISION		
PROJECT	KHURJA SUPER THERMAL POWER PROJECT STAGE – I (2x660MW)		
TITLE	SCHEMATIC DIAGRAM FOR A/C SYSTEM FOR SERVICE BUILDING		
SIZE A1	SCALE NTS	DRG.NO. 9915-002-POM-A-056	REV. 01



- # FIRE FIGHTING-LEGEND
1. HYDRANT LINE RING NO.1(MAIN PLANT)	
2. HYDRANT LINE RING NO.2	
3. SPRAY LINE	
4. HYDRANT BOOSTER LINE	
5. SPRAY BOOSTER LINE	
6. ISOLATION VALVE (GATE VALVE) NORMALLY OPEN	
7. FIRE WATER PIPES ON TRESTLE (IN WS PACKAGE SCOPE) TRESTLE (IN SG PACKAGE SCOPE) TRESTLE (IN TG PACKAGE SCOPE)	  
8. FIRE WATER PIPES IN TRENCHES	
9. UNDER GROUND (BURIED) FIRE WATER PIPES	
10. FIRE WATER PIPES ON PEDESTALS	

Scope of Fire Detection & Protection System (FDPS) portion of civil works in Main Power Block		
Work Description	In all areas/ facilities/ Buildings covered under	
	Steam Turbine Generator (STG) Island Package	Steam Generator (SG) Island Package
RCC Trenches & valve pits for Fire water pipes. Trenches crossing Drains.	STG ISLAND PACKAGE	SG ISLAND PACKAGE
Excavation for Buried Fire water pipes and backfilling till FGL	WATER SYSTEM PACKAGE	WATER SYSTEM PACKAGE
Interlocking concrete block paving over buried Fire water pipes	STG ISLAND PACKAGE	SG ISLAND PACKAGE
Deluge valve housing	WATER SYSTEM PACKAGE	WATER SYSTEM PACKAGE
PCC encasement for buried Fire water pipes in road/ drain crossing including rectification of roads/ drains	WATER SYSTEM PACKAGE	WATER SYSTEM PACKAGE
Rail crossing for Fire water pipes with NP4 hume pipes	STG ISLAND PACKAGE	SG ISLAND PACKAGE

NOTE: CIVIL WORKS FOR FDPS IN MAIN PLANT POWER BLOCK SHALL BE AS INDICATED IN ABOVE TABLE. FOR REMAINING AREAS OTHER THAN MAIN PLANT POWER BLOCK, CIVIL WORKS (EXCEPT FOR FIRE WATER PIPES RUNNING ON DUST SUPPRESSION PIPE PEDESTALS IN COAL STOCKYARD AREA) INCLUDING HUME PIPES FOR FDPS SHALL BE IN THE SCOPE OF WATER SYSTEM PACKAGE.

FOR TENDER PURPOSE ONLY			
OWNER		THDC INDIA LIMITED (A JV OF GOVT. OF INDIA & GOVT. OF UP)	
CONSULTANT 		<i>NTPC Limited</i> (A GOVT. OF INDIA ENTERPRISE) CONSULTANCY WING	
PROJECT		KHURJA SUPER THERMAL POWER PROJECT (2 X 660 MW)	
TITLE		FIRE DETECTION & PROTECTION SYSTEM LAOYOUT OF FIRE HYDRANT & SPRAY MAINS	
SIZE A0	SCALE NTS	(DRC.NO.)	9915-999-POM-A-046 2 1
			REV. A

A	RELEASED FOR TENDOR PURPOSE													TARUN	KV	KV	SJ										SKJ	24-7-18		
REV.	DESCRIPTION													DRAWN	DESIGN	CHKD	PU	L/O	SG	LP	MH	WS	E	C	CDI	APPD	DATE			
F ₁		F ₂													A															

**LETTER OF SUPPORT FOR SATISFACTORY PERFORMANCE OF
..... (Name of Plant / System*) FOR KHURJA STPP (2X660MW)**

TO

[EMPLOYER'S NAME & ADDRESS]

Sub: Letter of Technical Support submitted From (name of the Associate*/ Collaborator*/ Technology provider* / Licensor* / Holding Company*) undertaking the responsibility for satisfactory performance of(name of the plant/system*).

Dear Sirs,

1. In accordance with the Award of the Contract by (Name of the Contractor) to M/s. (Name of the sub-vendor), we, the aforesaid Associate*/Collaborator*/Technology provider*/Licensor*/Holding Company, (M/s) shall be fully responsible for the satisfactory performance of the(plant system* name).
2. Further, the manner of achieving the objective set forth in point 1 above shall be as follows
For (Plant/system* name):
 - (a) We shall be fully responsible for design, engineering & commissioning and extending all necessary support for putting in to satisfactory operation and carrying out the Guarantee Tests for(plant/system* name) to the satisfaction of the Employer.
 - (b) We shall depute technical experts to Bidder's/sub-vendor's works for supervision during manufacturing, assembly, inspection, as and when required by Employer. We shall participate in site erection, commissioning and final testing (as and when necessary) of the..... (Plant/system* name).
 - (c) We shall participate in Technical Co-ordination meetings (TCMs) from time to time, as and when required by Employer.
 - (d) We shall promptly carry out all the corrective measures and shall promptly provide corrected design and shall undertake replacements, rectifications or modifications to the plant/system* as and when required by Employer in case the plant/system* fails to demonstrate successful performance as per contract at site.
3. We, the Associate*/Collaborator*/Technology provider*/Licensor*/Holding company* do hereby undertake and confirm that this Letter of Technical Support shall be valid for a period of seven (7) years or up to the end of defect liability period of the contract, whichever is later.

Signature of the Authorised Representative:.....

For M/s

(Associate*/Collaborator*/Technology provider*/Licensor*/Holding company)

Name

Designation

Date:.....

Common Seal of the Company

***: Strike off whichever is not applicable.**

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

SL. NO.	SPECIFICATION REFERENCE				Existing	Read as
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
1.	VI/B	A-01	2 of 3	1.04.00	The plant shall be designed to operate continuously under two shift and cyclic modes. The design would cover adequate provision for quick startup and loading of the units to full load at a fast rate. The unit shall have minimum rate of loading or unloading of 5% per minute above the control load (i.e. 50% MCR). Plant shall be capable of minimum N1 number of daily load cycles (N1 shall not be less than 2), i.e. load variation from 100% to 50 % (and vice versa) of MCR without affecting the design life of boiler and turbine systems. In addition, the plant shall also be capable of minimum N2 number of daily load cycling (N2 shall not be less than 1) from 50% to 30% (and vice versa) of MCR with a minimum ramp rate of 3% per minute without affecting the design life of boiler and turbine systems. Bidder shall fill the values of N1 and N2 in Attachment 8(P) and shall demonstrate the same during initial operation. The main plant and its auxiliaries with their controls would be designed to permit operation of the units on house load without there being any necessity to shut down the units in the event of sudden loss of total load due to tripping of transmission lines or any other grid disturbances. The design of the plant equipments and control system would permit participation of the plant in automatic load frequency control.	The plant shall be designed to operate continuously under two shift and cyclic modes. The design would cover adequate provision for quick startup and loading of the units to full load at a fast rate. The unit shall have minimum rate of loading or unloading of 5% per minute above the control load (i.e. 50% MCR). Plant shall be capable of minimum N1 number of daily load cycles (N1 shall not be less than 2), i.e. load variation from 100% to 50 % (and vice versa) of MCR without affecting the design life of boiler and turbine-Generator systems. In addition, the plant shall also be capable of minimum N2 number of daily load cycling (N2 shall not be less than 1) from 50% to 30% (and vice versa) of MCR with a minimum ramp rate of 3% per minute without affecting the design life of boiler and turbine-Generator systems. Bidder shall fill the values of N1 and N2 in Attachment 8(P) and shall demonstrate the same during initial operation. The main plant and its auxiliaries with their controls would be designed to permit operation of the units on house load without there being any necessity to shut down the units in the event of sudden loss of total load due to tripping of transmission lines or any other grid disturbances. The design of the plant equipments and control system would permit participation of the plant in automatic load frequency control.
2.	VI/B	A-3	3 of 92	1.01.03 (a)	Bidder can offer overload valve 77 mm Hg (abs) with 3% makeup. Load requirement beyond 102% of rated load can be met with overload valve.	Bidder can offer overload valve 77 mm Hg (abs) with 3% makeup. Load requirement beyond 102% of rated load can be met with overload valve. OLV operation shall also be envisaged for entire range of plant operation to meet the instantaneous increase in load demand.

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3.	VI/B	A-3	3 of 92	1.01.03 (a)	The employer intends to provide a steam generator for each unit having Boiler maximum continuous rating (BMCR) of 102% of the turbine VWO steam flow requirement subject to a minimum of 2580 Tonnes/hr. For sizing of various auxiliaries in Bidder's scope of supply like BFP, HP-LP Bypass system etc. the Bidder shall therefore consider BMCR steam flow of 2580 T/hr. or 102% of turbine VWO steam flow, whichever is higher.	The employer intends to provide a steam generator for each unit having Boiler maximum continuous rating (BMCR) of 102% of the turbine VWO steam flow requirement subject to a minimum of 2100 Tonnes/hr. For sizing of various auxiliaries in Bidder's scope of supply like BFP, HP-LP Bypass system etc. the Bidder shall therefore consider BMCR steam flow of 2100T/hr. or 102% of turbine VWO steam flow, whichever is higher.
4.	VI/B	A-3	12 of 92	1.07.00 (b)(3)	Necessary pick-ups and accessories for remote monitoring of bearing metal temperature & vibration as per standard practice of bidder.	Necessary pick-ups and accessories for remote monitoring of bearing metal temperature & vibration as per standard practice of bidder. Turbine protection on bearing temperature hi-hi and bearing vibration hi-hi shall also be envisaged.
5.	VI/B	A-3	15 of 92	1.13.00 (d)	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. This should be covered with prefabricated '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.	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. ~~This should be covered with prefabricated 'blanket' type insulation.~~ 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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6.	VI/B	A-3	20 of 92	1.18.00 (b)(2)	Centrifuge or any other type oil purification system as per turbine manufacturer's standard practice. All components of the oil purification system which are coming in contact with oil shall be constructed from high grade stainless steel.	Centrifuge or any other type oil purification system as per turbine manufacturer's standard practice. All components of the oil purification system including purifier vessel which are coming in contact with oil shall be constructed from high grade stainless steel.
7.	VI/B	A-3	20 of 92	1.18.00 (b)(3)(ii)	Electric oil heater to heat oil to temperature not more than 65°C with possibility to cut heater elements in steps. If coalescer type of oil purification system is envisaged then Electric oil heater for purification system may not be required.	Electric oil heater to heat oil to temperature not more than 65°C with possibility to cut heater elements in steps. If coalesce (other) type of oil purification system is envisaged then Electric oil heater for purification system may not be required. However in that case bidder shall provide heater in Main oil tank to increase Turbine lube oil temperature to the level as required by the Turbine OEM.
8.	VI/B	A-3	48 of 92	5.00.00 (j)	Tube sheet material carbon steel as per ASTM. A516 Grade 70 or SA 350 LF-2 and shall be welded to shell and water box. Tube support plates of common quality steel of 16mm (min) thickness.	Tube sheet material carbon steel as per ASTM. A516 Grade 70 or SA 350 LF-2 or SA-508 Gr 3 Cl-I and shall be welded to shell and water box. Tube support plates of common quality steel of 16mm (min) thickness.
9.	VI/B	A-3	52 of 92	5.03.01 (b)	Shell of carbon steel as per ASTM-516 Gr. 70 and water box channel and channel cover as per ASTM A-266 class-II / ASTM-516 Gr. 70 and shall be welded to tube sheet.	Shell of carbon steel as per ASTM-516 Gr. 70 and water box channel and channel cover as per ASTM A-266 class-II / ASTM-516 Gr. 70 / SA 533 Type B Cl 2 and shall be welded to tube sheet.

KHURJA SUPER THERMAL POWER PROJECT (2X 660 MW)

TURBINE GENERATOR AND ASSOCIATED PACKAGES

Bid Document No.: THDC/RKSH/CC-9915-371

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AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

10.	VI/A	FGLD	4 of 20	1.01.01 (ii)	(ii) Turbine cycle heat rate at 55% TMCR load Guaranteed Turbine Cycle Heat rate in Kcal/Kwhr under turbine throttle main steam pressure of 150 Kg/cm2(abs) and rated main steam and reheat steam temperature at 77 mmHg(abs) condenser pressure with zero make up at 363 MW load (i.e 55 % of rated load).	(ii) Turbine cycle heat rate at 55% TMCR load Guaranteed Turbine Cycle Heat rate in Kcal/Kwhr under turbine throttle main steam pressure of 150 Kg/cm2(abs) and rated main steam and reheat steam temperature at 77 mmHg(abs) condenser pressure with zero make up at 363 MW load (i.e. 55 % of rated load) with one TDBFP in operation.
11.	VI/A	FGLD	4 of 20	2.02.02	The essential mandatory requirements for instruments, methods and precautions to be employed shall be in accordance with the requirements specified in the respective codes. All the necessary instruments (in duplicate) required for the tests shall be furnished by the contractor so as to meet the accuracies specified in the codes.	The essential mandatory requirements for instruments, methods and precautions to be employed shall be in accordance with the requirements specified in the respective codes. All the necessary instruments (~~in duplicate~~) required for the tests shall be furnished by the contractor so as to meet the accuracies specified in the codes.
12.	VI/A	MS	1 of 59	1.01.00 (a)	The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any	The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item (~~except for items not applicable to the bidders design~~) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

13.	VI/A	MS	4 of 59	13.00	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the mandatory spares list.	Bidder shall not indicate “Not Applicable” against any of the spares (except for those items for which “if applicable” is specified). In case of not applicability, functionally equivalent spares to be mentioned with price in the relevant price schedules.
14.	VI/A	MS	4 of 59	17.00	If the same spare(s) is appearing at two different places, spare has to be considered at only one place, in order to avoid any duplicity.	If any item appears in more than one groups (Group A, B, C) same shall be considered by the bidder irrespective of duplicity and price shall be considered accordingly.
15.	VI/A	MS	10 of 59	B.I.37	Bellow/Compensator assemblies for LP cylinder/cylinders exhaust connecting with gland Box (Both front and Rear)IS APPLICABLE	Bellow/Compensator assemblies for LP cylinder/ cylinders exhaust connecting with gland Box (Both front and Rear) IF APPLICABLE
16.	VI/A	MS	15 of 59	C.1.x	Jacking oil hoses for all TG bearings	Jacking oil hoses for all TG bearings (if applicable).
17.	VI/A	MS	15 of 59	C.1.xi	NRV's on Jacking oil line to bearings	NRV's on Jacking oil line to bearings (if applicable).
18.	VI/A	MS	16 of 59	C.1.xvix	Duplex filter for Jacking oil system consisting of filter elements / cartridges, O-rings, gaskets except housing	Duplex filter for Jacking oil system consisting of filter elements / cartridges, O-rings, gaskets except housing (if applicable)
19.	VI/A	MS	16 of 59	C.1.xvx	Jacking oil pump pressure relief valve	Jacking oil pump pressure relief valve (if applicable)
20.	VI/A	MS	16 of 59	C.1.xvxi	Jacking oil header pressure regulating valve	Jacking oil header pressure regulating valve (if applicable)

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21.	VI/A	MS	20 of 59	C.15.2	Jacking oil pump complete assembly.	Jacking oil pump complete assembly (if applicable) .
22.	VI/A	MS	20 of 59	C.15.3	Jacking oil pump relief valve / Jacking oil header regulating valve	Jacking oil pump relief valve / Jacking oil header regulating valve (if applicable) .
23.	VI/A	MS	22 of 59	C.17(A)	Blade Vibration monitoring system:	Blade Vibration monitoring system (if applicable):
24.	VI/A	MS	22 of 59	C.17(A)	Full set means, Quantity corresponding to Integrated system for L-0 stage (Turbine and Generator end)	Full set means, Quantity corresponding to Integrated system for L-0 stage and L-1 stage (Turbine and Generator end)
25.	VI/A	MS	25 of 59	C.19.4.f	AC JOP motor for TDBFP	AC JOP motor for TDBFP (if applicable)
26.	VI/A	MS	25 of 59	C.19.4.g	Control fluid oil vapour exhaustor motor	Control fluid oil vapour exhaustor motor (if applicable)
27.	VI/A	MS	25 of 59	C.19.4.h	MOT centrifuge motor	MOT centrifuge motor (if coalesce type of purification unit is offered , then this will not be applicable)
28.	VI/A	MS	25 of 59	C.19.4.j	TDBFP centrifuge motor	TDBFP centrifuge motor (if coalesce type of purification unit is offered , then this will not be applicable)
29.	VI/A	MS	25 of 59	C.19.4.l	TDBFP transfer oil pump motor	TDBFP transfer oil pump motor (if applicable)

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

30.	VI/A	MS	59 of 59	GENERAL NOTE	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the mandatory spares list.	Bidder shall not indicate “Not Applicable” against any of the spare (except for those items for which “if applicable” is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules.
31.	VI/A	MS	59 of 59	GENERAL NOTE	-----	8. If any item appears in more than one groups (Group A, B, C) same shall be considered by the bidder irrespective of duplicity and price shall be considered accordingly 9. Wherever set is mentioned under quantity same shall mean the complete requirement of that item. 10. Wherever requirement for one unit/two unit is mentioned, it shall mean total population for one/two 660 MW unit.
32.	VI/B	A-3	90 of 92	ANNEXURE-II	(vi) Guarantee Condenser pressure : To be optimised by bidder but not exceeding 77 mmHg (abs). “Guarantee Condenser Pressure” is average of all the condenser pressures.	vi) Guarantee Condenser pressure : To be optimised by bidder but not exceeding 65 mmHg (abs). “Guarantee Condenser Pressure” is average of all the condenser pressures.
33.	VI/A	Functional Guarantee & Liquidated damage	7 of 20	1.01.02 (v) Upper limit	4200 KW	6550 KW

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

34.	VI/A	A-3	8 of 10	10.02.00	EOT CRANE FOR BOILER FEED PUMP Further the EOT crane shall have necessary facilities such as lifting beam with swivelling arrangement and slings for erection as well as maintenance of the equipment.				EOT CRANE FOR BOILER FEED PUMP Further the EOT crane shall have necessary facilities such as lifting beam with swivelling arrangement (if applicable) and slings for erection as well as maintenance of the equipment.								
35.	VI/A	A-8	2 of 2	2.01.00 (c)	Condenser water boxes (front & rear), vacuum pumps, CW butterfly valves, control fluid room etc.				Condenser water boxes (front & rear), vacuum pumps, CW butterfly valves,control fluid system etc.								
36.	VI/A	Functional Guarantee & Liquidated damage	5 of 20	1.01.02 (i)	<table><tr><td>For Increase in the Guaranteed Turbine Cycle heat rate in Kcal/Kwhr at 660MW under rated steam conditions at 77 mmHg(abs) condenser pressure with zero make up</td><td>US \$ 722,311 (US Dollar Seven Hundred Twenty Two Thousand Three Hundred Eleven only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate</td><td>(+) 1% of the Guaranteed turbine cycle heat rate.</td><td>1795 Kcal/Kwhr</td></tr></table>				For Increase in the Guaranteed Turbine Cycle heat rate in Kcal/Kwhr at 660MW under rated steam conditions at 77 mmHg(abs) condenser pressure with zero make up	US \$ 722,311 (US Dollar Seven Hundred Twenty Two Thousand Three Hundred Eleven only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate	(+) 1% of the Guaranteed turbine cycle heat rate.	1795 Kcal/Kwhr	<table><tr><td>For Increase in the Guaranteed Turbine Cycle heat rate in Kcal/Kwhr at 660MW under rated steam conditions at 77 mmHg(abs) condenser pressure with zero make up</td><td>US \$ 722,311 (US Dollar Seven Hundred Twenty Two Thousand Three Hundred Eleven only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate</td><td>(+) 2.5% of the Guaranteed turbine cycle heat rate.</td><td>1795 Kcal/Kwhr</td></tr></table>	For Increase in the Guaranteed Turbine Cycle heat rate in Kcal/Kwhr at 660MW under rated steam conditions at 77 mmHg(abs) condenser pressure with zero make up	US \$ 722,311 (US Dollar Seven Hundred Twenty Two Thousand Three Hundred Eleven only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate	(+) 2.5% of the Guaranteed turbine cycle heat rate.	1795 Kcal/Kwhr
For Increase in the Guaranteed Turbine Cycle heat rate in Kcal/Kwhr at 660MW under rated steam conditions at 77 mmHg(abs) condenser pressure with zero make up	US \$ 722,311 (US Dollar Seven Hundred Twenty Two Thousand Three Hundred Eleven only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate	(+) 1% of the Guaranteed turbine cycle heat rate.	1795 Kcal/Kwhr														
For Increase in the Guaranteed Turbine Cycle heat rate in Kcal/Kwhr at 660MW under rated steam conditions at 77 mmHg(abs) condenser pressure with zero make up	US \$ 722,311 (US Dollar Seven Hundred Twenty Two Thousand Three Hundred Eleven only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate	(+) 2.5% of the Guaranteed turbine cycle heat rate.	1795 Kcal/Kwhr														

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

37.	VI/A	Functional Guarantee & Liquidated damage	6 of 20	1.01.02 (ii)	For Increase in the Guaranteed Turbine Cycle Heat rate in Kcal/Kwhr under turbine throttle main steam pressure of 150 Kg/cm2(abs) and with rated steam temperature at 77 mmHg(abs) condenser pressure and zero make up at 363 MW	(US \$ 118,665 (US Dollar One Hundred Eighteen Thousand Six Hundred Sixty Five only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate	(+) 1% of the Guaranteed turbine cycle heat rate.	1905 Kcal/Kw hr		For Increase in the Guaranteed Turbine Cycle Heat rate in Kcal/Kwhr under turbine throttle main steam pressure of 150 Kg/cm2(abs) and with rated steam temperature at 77 mmHg(abs) condenser pressure and zero make up at 363 MW	(US \$ 118,665 (US Dollar One Hundred Eighteen Thousand Six Hundred Sixty Five only) per 1 Kcal/Kwhr increase in Turbine Cycle heat rate	(+) 2.5% of the Guaranteed turbine cycle heat rate.	1905 Kcal/Kwhr	

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

38.	VI/A	Functional Guarantee & Liquidated damage	2 of 20	1.00.01 (g)	The instruments to be used for process control shall also be used for PG test. Minimum number of instruments to be used for PG test has been identified in respective P&IDs with accuracy class meeting the code requirement. All instruments required for performance testing shall be of the type and accuracy required by the ASME PTC code. Prior to the start of the initial operation, the contractor shall get these instruments calibrated in an independent test Institute approved by the Employer. All test instrumentation, Personal computer(s), necessary server and required interface, software for on line computation of test results & report as required for PG tests shall be supplied by the contractor and shall be retained by the Employer.	~~The instruments to be used for process control shall also be used for PG test.~~ Minimum number of instruments to be used for PG test has been identified in respective P&IDs with accuracy class meeting the code requirement. All instruments required for performance testing shall be of the type and accuracy required by the ASME PTC code. Prior to the start of the initial operation, the contractor shall get these instruments calibrated in an independent test Institute approved by the Employer. All test instrumentation, Personal computer(s), necessary server and required interface, software for on line computation of test results & report as required for PG tests shall be supplied by the contractor and shall be retained by the Employer. Separate system shall be supplied for each unit. All calibration procedures and standards shall be subjected to the approval of the Employer. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes.
39.	VI/E	Tender Drawing	SI No. 21	9915-110-POM-A-016	9915-110-POM-A-016	Refer revised P& ID (9915-110-POM-A-016)
40.	VI/A	IV, Functional Guarantee	1.00.01 / (d)	1 of 20	All costs associated with the tests including cost associated with the calibration shall be included in the bid price.	All costs associated with the tests including cost associated with the supply , calibration, shall be included in the bid price.

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41.	VI/B	A-3 Turbine Generator And Auxiliaries	1.22.03	29 & 30 of 92	(1) Based on cycle condition & covering entire range of operation for Turbine & Condenser following correction curves for variation in turbine Heat rate & output to be furnished: The above list of correction curves is conclusive & curves in addition to above shall not be applied.	(1) Based on cycle condition & covering entire range of operation for Turbine following correction curves for variation in Turbine Cycle Heat rate at 100% load & 55% load & Turbine Generator output to be furnished along with bid: The above list of correction curves is conclusive & curves in addition to above shall not be applied. NOTE: In case any of the above correction curves are not submitted along with bid , no negative corrections shall be allowed on turbine Heat rate on this account .Positive corrections if required to be applied, the amount shall be decided by Employer. Further, no positive corrections shall be allowed on turbine output on this account. Negative corrections if required to be applied, the amount shall be decided by Employer. Above corrections curve shall be provided for following cases. a) 105% of TMCR for output guarantee. b) 100 % of TMCR for heat rate guarantee. c) 55% of TMCR for heat rate guarantee.

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42.	VI/P art-E			Tender	9915-999-POM-A-004	Revised P&ID. 9915-999-POM-A-004 9915-999-POM-A-005 9915-999-POM-A-006 9915-999-POM-A-007 9915-999-POM-A-008 9915-999-POM-A-009 9915-999-POM-A-010 9915-999-POM-A-011 9915-999-POM-A-012 9915-999-POM-A-013
				Drawing	9915-999-POM-A-005	
				9915-	9915-999-POM-A-006	
				999-	9915-999-POM-A-007	
				POM-A-	9915-999-POM-A-008	
				004	9915-999-POM-A-009	
				9915-	9915-999-POM-A-010	
				999-	9915-999-POM-A-011	
				POM-A-	9915-999-POM-A-012	
				005	9915-999-POM-A-013	
				9915-		
				999-		
				POM-A-		

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				POM-A-012 9915-999- POM-A-013		
43.	VI/A	A-5	2 of 2	2.04.00 (h)	Complete Effluent transfer system up to Ash slurry sump along with N-pit, Effluent re-circulation/disposal pumps, piping, valves, fittings etc.	Complete Effluent transfer system up to Ash slurry sump along with N-pit, Effluent re-circulation/disposal pumps & piping, valves, fittings etc up to Terminal point as specified elsewhere.
44.	VI/A	A-5	2 of 2	2.04.00 (i)	Waste water generated during resin transfer operation shall be collected in collection pit located in the regeneration area. Complete Waste water collection pit and disposal system up to CW channel near CW Pump House along with piping, valves, fittings, Resin transfer waste water disposal pumps (2x100%) etc.	Waste water generated during resin transfer operation shall be collected in collection pit located in the regeneration area. Complete Waste water collection pit and disposal system up to CW channel near CW Pump House along with Resin transfer waste water disposal pumps (2x100%) & piping, valves, fittings etc up to Terminal point as specified elsewhere.

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45.	VI/A	A-1	5 of 14 & 6 of 14	5.0 (iv)	iv) Condensate Polishing Plant (a) The Bidder/its Sub-vendor should have designed, supplied, erected and commissioned at least one (1) Condensate Polishing Plant of mixed bed, deep bed type consisting of service vessel of minimum capacity of 500 M³/hr. The plant shall have external regeneration system, incorporating the same resin separation and regeneration process as proposed by the Bidder / its Sub-vendor for this package. The above plant should have been in successful operation for a period of at least one (1) year. The Bidder/its Sub-vendor who do not meet the qualification requirements stipulated at 5.0(iv) (a) above, may also participate provided the Bidder/its Sub-vendor is a Contractor in water treatment plant and has executed at least one (1) number ion exchange based demineralising plant of minimum capacity of 60 Cu.m/hr consisting of maximum two (2) streams and associates for this bid with an Associate who in turn fully meets the requirements stipulated at 5.0(iv) (a) above.	iv) Condensate Polishing Plant (a) The Bidder/its Sub-vendor should have designed, supplied, erected and commissioned at least one (1) Condensate Polishing Plant of mixed bed, deep bed type consisting of service vessel of minimum capacity of 500 M³/hr. The plant shall have external regeneration system, incorporating the same resin separation and regeneration process as proposed by the Bidder / its Sub-vendor for this package. The above plant should have been in successful operation for a period of at least one (1) year. (b) The Bidder/its Sub-vendor who do not meet the qualification requirements stipulated at 5.0(iv) (a) above, may also participate provided the Bidder/its Sub-vendor is a Contractor in water treatment plant and has executed at least one (1) number ion exchange based demineralising plant of minimum capacity of 60 Cu.m/hr consisting of maximum two (2) streams and associates for this bid with an Associate who in turn fully meets the requirements stipulated at 5.0(iv) (a) above. In such a case, the Bidder/its Sub-vendor shall be required to furnish a letter of technical support from Collaborator / Associate for successful performance of Condensate Polishing Plant, as per the format enclosed in Annexure-A1. This letter of technical support should be submitted to Employer prior to the placement of order on approved sub-vendor.
46.	VI/A	Mandatory Spares (Group-B, IX)	14 of 59	IX.11(iv)	ECW pump motor for TG auxiliaries	Deleted

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

47.	VI/ A	Terminal Points & Exclusio ns	2 to 6	5.01.02	Secondary cooling water circuit for SG cooling: - For each unit, Bidder shall terminate be provided by Employer. The cooling water flow shall be about 1500 Cu.M/hr. Employer shall terminate discharge header. The return hot secondary cooling water circuit flow of 1500 Cu.M/hr shall be limited to	Secondary cooling water circuit for SG cooling: - For each unit, Bidder shall terminate be provided by Employer. The cooling water flow shall be about 1800 Cu.M/hr. Employer shall terminate discharge header. The return hot secondary cooling water circuit flow of 1800 Cu.M/hr shall be limited to
48.	VI Part -B	Chapter A6 Low Pressure Piping System	--	--	Pg. No. 1 to 6 Part - A	Refer Annexure A Part – B Pg. No. 1 - 21
49.	VI Part -B	Chapter A9 Power Cycle Piping System	--	--	Pg. No. 1 to 10 Part - A	Refer Annexure B Part – B Pg. No. 1 - 32

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50.	VI/ B	A-02	7	1.03.00/ 22	Steam turbine, Generator and other equipment located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. Wherever special handling procedures are to be followed such as for the generator stator, rotor withdrawal of Generator etc., the same shall be described in written out document and attached with the bid. The offered layout of TG Hall shall be such that it shall be feasible to remove the Generator Stator and send it for repair without removal of any equipment located in TG Hall. Erection of STG Stator shall be carried out either by tandem operation of EOT cranes or by separate portal cranes / strand jack arrangement. In case auxiliaries such as BFP set are not in the reach of TG hall EOT crane, then separate EOT crane for each unit with proper maintenance area near BFP set shall be provided for complete maintenance of BFP and its auxiliaries. Further, all tools, motorized trolleys etc. required for removal and transportation of BFP set equipment to the unloading bay in TG hall AB bay shall be provided.	Steam turbine, Generator and other equipment located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. Wherever special handling procedures are to be followed such as for the generator stator, rotor withdrawal of Generator etc., the same shall be described in written out document and attached with the bid. The offered layout of TG Hall shall be such that it shall be feasible to remove the Generator Stator and send it for repair without removal of any equipment located in TG Hall. Erection of STG Stator shall be carried out either by tandem operation of EOT cranes or by separate portal cranes / strand jack arrangement. In case auxiliaries such as BFP set are not in the reach of TG hall EOT crane, then separate EOT crane for each unit with proper maintenance area near BFP set shall be provided for complete maintenance of BFP and its auxiliaries. The Bidder shall furnish the equipment lay down area for TDBFP and MDBFP parts/components with details such as blocks indicating orientation of dismantled items, travel path etc. for each unit necessarily by BFP EOT crane. Further, Bidder shall furnish handling arrangement drawing including special arrangements, pedestals, fixtures etc. for withdrawal / placement in laydown area. Bidder shall ensure obstruction free access path/walkway around TDBFP and MDBFP sets and approach to measuring instruments, valves, bearings etc. In case acoustic enclosures is envisaged, free access as elaborated above shall also be ensured with in
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-04	PAGE 16 OF 91

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						the enclosure. Bidder to plan accordingly taking care of integral piping, lube oil piping, cabling, LIE/LIR etc. and 3D model shall incorporate all these facilities and 2D drawing extracted from 3D drawing shall be submitted. Pit shall be avoided for housing the lube oil system of TDBFP. In case bidder opts for pit, pit invert level shall be kept such that the clear headroom of min. 2.1 m shall be available from the grating platform. Access to top of the oil tank shall be ensured from EL 0.0M floor. Bidder shall ensure 600mm walkway all around the equipment/tank after all the oil/water/firefighting piping, cable trays etc. are considered. Free access to the pumps, valves and instruments shall be ensured. Entire access path shall be approachable from all the staircases. Further Bidder to plan in advance and model all the equipment and piping including firefighting pipes inside oil pit area, in order to maintain clear walkway requirements.
51.	VI/ E	Tender drawing		Sl.No.-2	Equipment layout plan at 0.0 M (Side Mill Arrangement) Drg No- 9915-999-POM-F-001 (Rev-A)	Equipment layout plan at 0.0 M (Side Mill Arrangement) Drg No- 9915-999-POM-F-001 (Rev-B)
52.	VI/ E	Tender drawing		Sl.No.-5	Equipment layout plan at 0.0 M (Front Mill Arrangement) Drg no- 9915-999-POM-F-004 (Rev-A)	Equipment layout plan at 0.0 M (Front Mill Arrangement) Drg no- 9915-999-POM-F-004 (Rev-B)

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53.	VI/ C	GTR	15-16 of 89	8.03.04/ C	Contractor shall prepare the model of all the facilities located in TG building (including all facilities), and any other facility located in TG building area in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, intelligent P&ID correlated with intelligent 3D Model, BOQ, schematics and logic diagrams etc. attached to the respective equipment / systems in the aforesaid 3D model. All piping layouts, equipment layouts, floor plans, ducting layout (A/C, Ventilation etc.), General Arrangement drawings of major buildings, 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 and provide 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 and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as and when required by employer.. After the completion of engineering of facilities covered under this package, the corresponding complete 3D review model shall be handed over to the employer for its reference.	Contractor shall prepare the model of all the facilities located in TG building (including all owner facilities) and the facilities in this package in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software. All piping layouts, equipment layouts, floor plans, ducting layout (A/C, Ventilation etc.), General Arrangement drawings of major buildings 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 NTPC to review and approve these drawings. Contractor shall prepare and provide 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 and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as and when required by employer. After the completion of engineering of facilities covered under this package, the corresponding complete 3D review model shall be handed over to the employer for its reference.
54.	VII/ E	Tender drawing		SI.No.-2	Pipe & cable trestle layout, Drg No- 9915-999-POM-F-006 (Rev-A)	Pipe & cable trestle layout, Drg No- 9915-999-POM-F-006 (Rev-B)

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

55.	VI/B	A10	3 of 37	2.00.00	18.1. As per ECBC codes minimum coefficient of performance (COP) for the chiller shall be as follows (based on AHRI conditions): 	DELETED																					
56.	VI/B	A10	4 of 37	2.00.00	18.5 Insulation for supply and return air ducts: Supply and return ducts shall be insulated.	18.5 Insulation for A/C ducts: A/C ducts shall be insulated.																					
57.	VI/B	A10	4 of 37	2.00.00	NIL	Following clause has been added: 20. All water cooled & air cooled chiller shall be designed with minimum COP as mentioned below: (a) Water cooled rotary screw chillers (based on AHRI conditions): <table><tr><td>Sl. No.</td><td>Chiller Capacity</td><td>Min COP</td></tr><tr><td>01.</td><td>Upto 150 TR</td><td>4.7</td></tr><tr><td>02.</td><td>≥ 150 TR < 300 TR</td><td>5.4</td></tr><tr><td>03.</td><td>≥300 TR</td><td>5.75</td></tr></table> (b) Air-cooled chillers (based on AHRI conditions): <table><tr><td>Sl.No.</td><td>Chiller Capacity</td><td>Min COP</td></tr><tr><td>01.</td><td>Upto 150 TR</td><td>2.9</td></tr><tr><td>02.</td><td>≥150 TR</td><td>3.05</td></tr></table>	Sl. No.	Chiller Capacity	Min COP	01.	Upto 150 TR	4.7	02.	≥ 150 TR < 300 TR	5.4	03.	≥300 TR	5.75	Sl.No.	Chiller Capacity	Min COP	01.	Upto 150 TR	2.9	02.	≥150 TR	3.05
Sl. No.	Chiller Capacity	Min COP																									
01.	Upto 150 TR	4.7																									
02.	≥ 150 TR < 300 TR	5.4																									
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Sl.No.	Chiller Capacity	Min COP																									
01.	Upto 150 TR	2.9																									
02.	≥150 TR	3.05																									

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

58.	VI/B	A10	5 of 37	3.00.00	e) Fresh air fans (no stand-by) shall be for each AHU room.	e) Fresh air fans (no stand-by) shall be for each AHU room. However, AHUs of Service Building shall be provided with modulating fresh air dampers (with filters) to regulate fresh air based on feedback from CO2 Sensors.
59.	VI/B	A10	24 of 37	7.02.02	The basic function of the system..... and humidity of “CR, CER, SWAS control room, UPS and Battery Charger room, static excitation room (as applicable)” and “ESP control rooms, FGD control room & AHP control room” shall be maintained by controlling the chilled water flow by means of motor operated three way modulating valve at chilled water line, humidified system and duct heater.	The basic function of the system..... and humidity of “CR, CER, SWAS control room, UPS and Battery Charger room, static excitation room (as applicable)” shall be maintained by controlling the chilled water flow by means of motor operated three way modulating valve at chilled water line, humidified system and duct heater.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

60.	VI/B	A10	24 of 37	7.02.03	Bidder shall provide Microprocessor/PLC based Control System along with Human Machine Interface System with two nos. Operator work station and one (1) no A-4 size color laser printer located at service building control room. For Service building, inside room temperature and humidity shall be maintained by varying the chilled water flow of secondary chilled water pumps through VFD driven motor and by varying the air flow of AHU through VFD driven motor, humidified system and duct heater. For sequential operation/duty cycling, programmed startup/stop of individual AHU's, pumps and cooling towers as per operating requirements and inside room temperature and humidity. Adequate no's of VAV box shall be provided for optimum use of VFD driven AHUs. Adequate nos. of occupancy sensor and day light sensor shall be provided. CO2 sensor shall be provided in each AHU room to regulate the fresh air fan damper.	For Service building, inside room temperature and humidity shall be maintained by varying the chilled water flow of secondary chilled water pumps through VFD driven motor and by varying the air flow of AHU through VFD driven motor, humidified system and duct heater. For sequential operation/duty cycling, programmed startup/stop of individual AHU's, pumps and cooling towers as per operating requirements and inside room temperature and humidity. Adequate no's of VAV box shall be provided for optimum use of VFD driven AHUs. Adequate nos. of occupancy sensor shall be provided. CO2 sensor shall be provided in each AHU room to regulate the fresh air.
61.	VI/B	A10	24 of 37	7.02.04	The operation of each Air Conditioning system shall be possible through Microprocessor based dedicated controllers to be provided by Contractor for each Screw /centrifugal Chiller units with local start / stop & indication for main plant A/C system in addition to Main DDCMIS based Control system of A/C plant (provided by contractor) for "Main plant area", "ESP control rooms, FGD control room & AHP control room". Further these microprocessor based control panels of Chiller units shall be suitably interfaced with DDCMIS based Control panels.	The operation of each Air Conditioning system shall be possible through Microprocessor based dedicated controllers to be provided by Contractor for each Screw /centrifugal Chiller units with local start / stop & indication for main plant A/C system in addition to Main DDCMIS based Control system of A/C plant (provided by contractor) for "Main plant area", "Service Building". Further these microprocessor based control panels of Chiller units shall be suitably interfaced with DDCMIS based Control panels.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

62.	VI/B	A10	27 of 37	7.07.00	e) Relative humidity and temperature measurement of all control rooms and CERs, ESP control room , FGD control room and all major air-conditioned areas shall be available in DDCMIS. Relative humidity and temp. measurement for main plant control room and CERs to be available in multiple numbers.	e) Relative humidity and temperature measurement of all control rooms, CERs, Service Building and all major air-conditioned areas shall be available in DDCMIS. Relative humidity and temp. measurement for main plant control room and CERs to be available in multiple numbers.																																				
63.	VI/B	A11	2 of 25	2.00.00	9. Type of ventilation for various buildings shall be as follows: <table><tr><th>S. No.</th><th>Area</th><th>Type of Ventilation system</th></tr><tr><td>(i)</td><td>General area like pump house, etc.</td><td>Combination of Supply air fan & Exhaust air fans/Roof Extractor Fans</td></tr><tr><td>(ii)</td><td>MCCs, Switchgear room, Cable Vault (other than ESP/FGD Building), etc.</td><td>Supply air fans & Back draft dampers</td></tr><tr><td>(iii)</td><td>Battery rooms</td><td>Combination of Air Intake Louvers & Exhaust air fans</td></tr><tr><td>(iv)</td><td>Cable Galleries of ESP/FGD Building</td><td>UAF systems along with back draft dampers</td></tr><tr><td>(v)</td><td>Toilet/pantry etc.</td><td>Exhaust air fans</td></tr></table>	S. No.	Area	Type of Ventilation system	(i)	General area like pump house, etc.	Combination of Supply air fan & Exhaust air fans/Roof Extractor Fans	(ii)	MCCs, Switchgear room, Cable Vault (other than ESP/FGD Building), etc.	Supply air fans & Back draft dampers	(iii)	Battery rooms	Combination of Air Intake Louvers & Exhaust air fans	(iv)	Cable Galleries of ESP/FGD Building	UAF systems along with back draft dampers	(v)	Toilet/pantry etc.	Exhaust air fans	9. Type of ventilation for various buildings shall be as follows: <table><tr><th>S. No.</th><th>Area</th><th>Type of Ventilation system</th></tr><tr><td>(i)</td><td>General area like pump house, etc.</td><td>Combination of Supply air fan & Exhaust air fans/Roof Extractor Fans</td></tr><tr><td>(ii)</td><td>MCCs, Switchgear room, Cable Vault (other than TG Building), etc.</td><td>Supply air fans & Back draft dampers</td></tr><tr><td>(iii)</td><td>Battery rooms</td><td>Combination of Air Intake Louvers & Exhaust air fans</td></tr><tr><td>(iv)</td><td>MCCs, Switchgear room, Cable Vault in TG Building</td><td>Air washer systems along with back draft dampers</td></tr><tr><td>(v)</td><td>Toilet/pantry etc.</td><td>Exhaust air fans</td></tr></table>	S. No.	Area	Type of Ventilation system	(i)	General area like pump house, etc.	Combination of Supply air fan & Exhaust air fans/Roof Extractor Fans	(ii)	MCCs, Switchgear room, Cable Vault (other than TG Building), etc.	Supply air fans & Back draft dampers	(iii)	Battery rooms	Combination of Air Intake Louvers & Exhaust air fans	(iv)	MCCs, Switchgear room, Cable Vault in TG Building	Air washer systems along with back draft dampers	(v)	Toilet/pantry etc.	Exhaust air fans
S. No.	Area	Type of Ventilation system																																								
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64.	VI/E	-	-	26	Schematic diagram of Air Conditioning System for Main Plant TG Building (9915-002-POM-A-054), Rev-00	Schematic diagram of Air Conditioning System for Main Plant TG Building (9915-002-POM-A-054), Rev-01
65.	VI/E	-	-	27	Schematic diagram of Air Conditioning System for Service Building (9915-002-POM-A-056), Rev-00	Schematic diagram of Air Conditioning System for Service Building (9915-002-POM-A-056), Rev-01
66.	VI/E	-	-	27a	NIL	Following tender drawing has been added: Layout of Fire hydrant and spray mains (9915-999-POM-A-046, Rev-A)
67.	VI/A	-	10 of 20	1.01.03	Auxiliary Power Consumption: Notes: 4. Duty factor for A/C equipments of service building shall be 0.5.	Auxiliary Power Consumption: Notes: 4. Duty factor for A/C equipments of service building shall be 0.5. Duty factor for A/C equipments of TG building shall be 1.0 5. Power consumption at rated duty point sl. no- (p) and (r) to be arrived at based on shop test. However, power consumption of water cooled chillers shall be based on site test.

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68.	VI/B	A10	5 of 37	3.01.00, d)	100% standby shall be provided for control rooms/RIO room/etc. served by ductable split/package and non-ductable split (cassette / Hi-wall) type air conditioners. No standby shall be provided for office areas of buildings served by split/package air conditioners.	100% standby shall be provided for control rooms/RIO room/etc. served by ductable split/package type air conditioners. At least one (1) no. unit, capacity same as each working unit as a common standby shall be provided for control rooms/RIO room/etc. served by non-ductable split (cassette / Hi-wall) type air conditioners. No stand-by shall be provided for office areas of buildings served by split/package air conditioners.

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69.	VI/B	B-0	6 of 9	3.11.00	Area	DC Voltage	Load	Minimum Battery Bank Rating					
					Unit	220 V	Total DC load of the unit at an acceptable voltage for at least 30 minutes	1500AH for lead acid Plante type /990 AH for Ni-Cd High Discharge (KPH) type batteries		Area	DC Voltage	Load	Battery Bank Rating
					AWRS /Seepage water system, Ash silos,	220 V/ 110 V	supply total DC load of the associated area at an acceptable voltage for at least 30 minutes	150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge (KPH) type batteries		Unit	220 V	Total DC load of the unit at an acceptable voltage for at least 30 minutes	2x1500AH for lead acid Plante type /2x990 AH for Ni-Cd High Discharge (KPH) type batteries

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70.	VI/B	B-06	26 of 62	21.04.00	Ammeters provided for motor feeders (for motors of rating $\geq 30\text{kW}$ & $< 100\text{kW}$) shall have a compressed scale at the upper current region to cover the starting current up to 6.0 times the CT primary current.	Ammeters provided for motor feeders (as applicable) shall have a compressed scale at the upper current region to cover the starting current up to 6.0 times the CT primary current.
71.	VI/B	B-01	24 of 40	10.06.05 e)	PSS shall be suitable for damping the various modes of electro-mechanical oscillations at all frequencies in the range of 0.2 to 3 Hz under varying generator loading and power system network configurations. PSS shall be adaptive to varying operating conditions with features to compute optimum stabilising signal along with suitable scheme for identifying external reactance of the generator. Facility for remote manual switch off-on along with indication shall be incorporated. Automatic supervision and blocking/switch off facility along with indications, etc. shall also be provided.	PSS shall be suitable for damping the various modes of electro-mechanical oscillations at all frequencies in the range of 0.2 to 3 Hz under varying generator loading and power system network configurations. PSS shall be adaptive to varying operating conditions with features to compute optimum stabilising signal along with suitable scheme for identifying external reactance of the generator. Facility for remote manual switch off-on along with indication shall be incorporated.
72.	VI/B	B-01	28 of 40	11.05.00	There shall be a pulse transformer between the individual gates of the parallel connected thyristors and between the main current circuit and the control circuit. Their amplitudes shall be depending upon the trigger characteristics, approximately +3 to +20V peak against cathode.	There shall be a pulse transformer between the individual gates of the parallel connected thyristors and between the main current circuit and the control circuit.

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73.	VI/B	B-7	2 of 11	6.02.01	Adequately sized galvanised mild steel earthbar shall run along the length of busduct. Each enclosure section to be connected to the earthbar at both ends. Both ends of earthbar to be connected to plant earthmat.	Adequately sized galvanised mild steel or aluminum earthbar shall run along the length of busduct. Each enclosure section to be connected to the earthbar at both ends. Both ends of earthbar to be connected to plant earthmat. Alternatively the ground bus may be the enclosure itself, if a continuous electrical path can be provided of the same momentary withstand current rating as the main bus conductors.
74.	VI/B	B-01	27 of 40	11.02.00 (a) and 11.02.00 (b)	Rectifier Transformer a) Type Indoor, epoxy moulded dry type, 3 phase step down transformer with Thermal Class 155 (F) insulation complete with flanges and terminal lugs for connection to the generator terminals through isolated phase bus ducts. The transformer shall conform to IEC-60076-11. Transformer shall be provided with fans/blowers (with 100 % standby) for forced air cooling however all tests and performance shall correspond to air natural cooling. Fans/Blowers (AF cooling) shall have Manual and Auto control. b) Temperature rise 70 deg.C over an ambient temperature of 50 deg.C.	Rectifier Transformer a) Type Indoor, electrolytic grade Copper winding, epoxy moulded dry type, 3 phase step down transformer with Thermal Class 155 (F) insulation complete with flanges and terminal lugs for connection to the generator terminals through isolated phase bus ducts. The transformer shall conform to IEC-60076-11. Transformer shall be provided with fans/blowers for forced air cooling however all tests and performance shall correspond to air natural cooling. Fans/Blowers (AF cooling) shall have Manual and Auto control. b) Temperature rise 70 deg.C over an ambient temperature of 50 deg.C without fan/blower and 65 deg.C. over an ambient temperature of 50 deg.C with fan/blower

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

75.	VI/A		65 of 106	Format for filling the details of provenness of Generator	Details of provenness of the offered generator as per clause no. 2.0 sub-section A-1, Part-A, section-VI of bidding documents	Details of provenness of the offered generator as per clause no. 6.1.0 sub-section A-1, Part-A, section-VI of bidding documents
76.	VI/B	B-11	7 of 12	20.01.00	VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application. These motors shall be provided with insulated bearing on at least one side.	VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application. These motors shall be provided with insulated bearing on at least one side for motor frame size above 250 frame.

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77.	VI/A	IV	8 of 20	1.01.03	Auxiliary Power Consumption $P_a = P_u + T_L$ T_L = Losses of the transformers supplied by bidder based on works test reports.	Auxiliary Power Consumption $P_a = P_u + T_L + T_R/2^*$ T_L = Losses of all the transformers supplied by bidder based on works test reports. T_R = Losses of all the reactors supplied by bidder based on works test reports. NOTE: Transformer losses (T_L) and Reactor Losses (T_R) shall be considered as per following GT - 100% no load loss, 54% of Copper losses & 100% Cooler Loss. UT – 100% no load loss, 52% of Copper losses & 50% Cooler Loss. ST– 100% no load loss, 8% of Copper losses & 9% Cooler Loss Aux/LT Indoor Transformer: 100% no load loss & 25% of Copper losses Reactor – losses at rated voltage * Loss of one number 80 MVAR (143 KW) and One number 125 MVAR (280 KW) reactor have been considered in value specified for Aux. power guarantee purpose. Specified values of Actual losses (T_R) shall be increased or decreased based on actual numbers and ratings of reactors supplied

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						for the project.
78.	VI	PART-A	PAGE 4 OF 6	8.00.00	8.00.00 ELECTRICAL 8.01.00 Terminal point for Construction power – construction power at two points at 11kV near TG area. 8.02.00 Terminal Points for Transformermer/Switchgear shall be as indicated in Electrical SLD Tender Drawing No.: 9915-999-POE-J-002. 8.03.00 LT terminals of all Employer's Transformers 8.04.00 Terminal block of HT motors.	8.00.00 ELECTRICAL 8.01.00 Terminal point for Construction power – construction power at two points at 11kV near TG area. 8.02.00 Terminal Points for Transformer/Switchgear shall be as indicated in Electrical SLD Tender Drawing No.: 9915-999-POE-J-002.
79.	VI	PART-E	PAGE 4 OF 4	SL NO .54	TENDER DRAWING LIST 54. Single Line Diagram- STG PKG. XXXX-371-999-POE-J-002 Rev A	TENDER DRAWING LIST 54. Single Line Diagram- STG PKG. 9915-999-POE-J-002 Rev B
80.					Single Line Diagram- STG PKG. XXXX-999-POE-J-002 Rev A	Single Line Diagram- STG PKG. 9915-999-POE-J-002 Rev B
81.	SECTION VI /A	APPENDIX IV	2 OF 4	2.00.00 (a)	Control room – operator desk along with monitors, two tier of Large Video Screens (LVS) mounted on LVS panel, PC racks behind LVS panels, Unit in-charge desks along with monitors, a few PCs and printers etc. with associated furniture.	Control room – operator desk along with monitors, two tier of Large Video Screens (LVS) mounted on LVS panel (with suitable cladding) , PC racks behind LVS panels, Unit in-charge desks along with monitors, a few PCs and printers etc. with associated furniture.
82.	SECTION VI /PART B	A 07 LAYOUT REQUIREMENTS	3 of 12	1.02.00 (ix)		Viewing Gallery at the entrance of Control Room from turbine floor.

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83.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	10 of 33	2.04.15	DDCMIS vendor shall upgrade/ update all DDCMIS system along with TG LAN to the latest version/ release of DDCMIS system software/ patches, meeting the system software requirements as mentioned in Part-B, SUB-SECTION-IIIC-02 DDCMIS. This shall include the latest OS (validated with the DCS) and its corresponding latest version/ release of DDCMIS system software/ patches. The upgrade/ update shall be carried out in the penultimate year of AMC (In case of one year AMC, third month from the date of commencement of AMC). Any change in hardware required for the same shall also be carried out by the contractor within the contract price.	DDCMIS vendor shall upgrade/ update all DDCMIS system along with TG LAN to the latest version/ release of DDCMIS system software/ patches, meeting the system software requirements as mentioned in Part-B, SUB-SECTION-IIIC-02 DDCMIS. This shall include the latest OS (~~validated with the DCS~~) and its corresponding latest version/ release of DDCMIS system software/ patches. The upgrade/update shall be checked for and carried out six months before the completion in the penultimate year of AMS of last DDCMIS (whose AMS started last). (~~In case of one year AMS, third month from the date of commencement of AMS~~). Any change in hardware and the requisite services (engineering/erection/commissioning/documentation) required for the same shall also be carried out by the contractor within the contract price.

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84.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	22 of 33	9.02.00	For certain auxiliary plants Technical Specification.			For certain auxiliary plants Technical Specification.		
					SI No	Auxiliary Plant	Control System	SI No	Auxiliary Plant	Control System
					01	Hydrogen Generation Plant	A) Independent Microprocessor/PLC based control system as per manufacturer's standard practice : 1 set B) Two nos. OWS and one no A4 color laser printer. C) Power supply system including batteries and battery chargers and associated cables etc. D) Dual 2-way Ethernet Connectivity utilizing OPC to Station LAN for information.	01	NOT USED	NOT USED
					02	Lub oil purification system(Main Turbine and Central Lub oil Purification system)	Local control panel for local operation and interface to TG control system controls	02	Lub oil purification system(Main Turbine and Central Lub oil purification system)	Local control panel for local operation and interface to TG control system controls

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85.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	22 of 33	9.03.00	All necessary equipments / system for monitoring and control of the electrical breaker like incomers, bus couplers etc. and their associated electrical signals like transformer IOs & switchgear IOs for each of the plant auxiliary system shall be provided. In addition to the above, for Hydrogen plant system, all necessary equipments / system for monitoring and control of minimum 7 nos. of electrical breaker (Employer scope) and their associated electrical signals like transformer IOs & switchgear IOs shall also be provided, if required.	All necessary equipments / system for monitoring and control of the electrical breaker like incomers, bus couplers etc. and their associated electrical signals like transformer IOs & switchgear IOs for each of the plant auxiliary system shall be provided. ~~In addition to the above, for Hydrogen plant system, all necessary equipments / system for monitoring and control of minimum 7 nos. of electrical breaker (Employer scope) and their associated electrical signals like transformer IOs & switchgear IOs shall also be provided, if required.~~

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86.	SECTION VI/A	APPENDIX - I TO SUB-SECTION -IIC-01 (CONTRACT QUANTITIES OTHER THAN DDCMIS ITEM)	2 OF 15	A	A. CONTRACT QUANTITIES FOR UCD & PANELS 1.00.00 CONTROL DESKS AND PANELS 1.01.00 The following are the contract quantities of furniture shall be provided as mentioned below:						A. CONTRACT QUANTITIES FOR UCD & PANELS 1.00.00 CONTROL DESKS AND PANELS 1.01.00 The following are the contract quantities of furniture shall be provided as mentioned below:																																																						
					<table><tr><th>Sl no</th><th>Area</th><th>Control Desk length</th><th>Qty</th><th>Item description for furniture / other items</th><th>Qty</th></tr><tr><td rowspan="4">1</td><td rowspan="4">Hydrogen Generation Plant</td><td rowspan="4"></td><td rowspan="4"></td><td>a. Chair</td><td>2 Nos.</td></tr><tr><td>b. Key pad</td><td>1 No.</td></tr><tr><td>c. Locker set</td><td>1 No.</td></tr><tr><td>d. Computer Table (Ref Note-1)</td><td>2 Nos.</td></tr><tr><td rowspan="4">2</td><td rowspan="4">CPU Remote Control Room (Regeneration)</td><td rowspan="4"></td><td rowspan="4"></td><td>a. Chair</td><td>2 Nos.</td></tr><tr><td>b. Key pad</td><td>1 No.</td></tr><tr><td>c. Locker set</td><td>1 No.</td></tr><tr><td>d. Computer Table (Refer Note-1)</td><td>1 No.</td></tr></table>						Sl no	Area	Control Desk length	Qty	Item description for furniture / other items	Qty	1	Hydrogen Generation Plant			a. Chair	2 Nos.	b. Key pad	1 No.	c. Locker set	1 No.	d. Computer Table (Ref Note-1)	2 Nos.	2	CPU Remote Control Room (Regeneration)			a. Chair	2 Nos.	b. Key pad	1 No.	c. Locker set	1 No.	d. Computer Table (Refer Note-1)	1 No.	<table><tr><th>Sl no</th><th>Area</th><th>Control Desk length</th><th>Qty</th><th>Item description for furniture / other items</th><th>Qty</th></tr><tr><td>1</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td></tr><tr><td rowspan="4">2</td><td rowspan="4">CPU Remote Control Room (Regeneration)</td><td rowspan="4"></td><td rowspan="4"></td><td>a. Chair</td><td>2 Nos.</td></tr><tr><td>b. Key pad</td><td>1 No.</td></tr><tr><td>c. Locker set</td><td>1 No.</td></tr><tr><td>d. Computer Table (Refer Note-1)</td><td>1 No.</td></tr></table>						Sl no	Area	Control Desk length	Qty	Item description for furniture / other items	Qty	1	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	2	CPU Remote Control Room (Regeneration)			a. Chair	2 Nos.	b. Key pad
Sl no	Area	Control Desk length	Qty	Item description for furniture / other items	Qty																																																												
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87.	SECTION VI/A	APPENDIX - I TO SUB-SECTION -IIC-01 (CONTRACT QUANTITIES OTHER THAN DDCMIS ITEM)	5 OF 15	B	B CONTRACT QUANTITIES FOR 24 V DC POWER SUPPLY SYSTEM 1.00.00 24 V DC POWER SUPPLY SYSTEM 1.01.00 24 V DC Power Supply systems shall be of continuous duty for the following estimated loads:- <table> <tr> <th>Description of Loads</th><th>Contractor's load</th><th>Power supply Configuration</th><th>Employer's load</th><th>Total Rating (Amp)</th><th colspan="2">Quantity</th></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td>Per unit</td><td>Common</td></tr> <tr> <td>2. Hydrogen Generation Plant (see notes below)</td><td></td><td>1. As per cl 1.03.00(D), Sub section-IIC-05</td><td>NIL</td><td></td><td></td><td>1 set</td></tr> </table>	Description of Loads	Contractor's load	Power supply Configuration	Employer's load	Total Rating (Amp)	Quantity							Per unit	Common	2. Hydrogen Generation Plant (see notes below)		1. As per cl 1.03.00(D), Sub section-IIC-05	NIL			1 set	B CONTRACT QUANTITIES FOR 24 V DC POWER SUPPLY SYSTEM 1.00.00 24 V DC POWER SUPPLY SYSTEM 1.01.00 24 V DC Power Supply systems shall be of continuous duty for the following estimated loads:- <table> <tr> <th>Description of Loads</th><th>Contractor's load</th><th>Power supply Configuration</th><th>Employer's load</th><th>Total Rating (Amp)</th><th colspan="2">Quantity</th></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td>Per unit</td><td>Common</td></tr> <tr> <td>2. NOT USED</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td><td>NOT USED</td></tr> </table>	Description of Loads	Contractor's load	Power supply Configuration	Employer's load	Total Rating (Amp)	Quantity							Per unit	Common	2. NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
Description of Loads	Contractor's load	Power supply Configuration	Employer's load	Total Rating (Amp)	Quantity																																											
					Per unit	Common																																										
2. Hydrogen Generation Plant (see notes below)		1. As per cl 1.03.00(D), Sub section-IIC-05	NIL			1 set																																										
Description of Loads	Contractor's load	Power supply Configuration	Employer's load	Total Rating (Amp)	Quantity																																											
					Per unit	Common																																										
2. NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED																																										

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88.	SECTION VI/A	APPENDIX - I TO SUB-SECTION -IIC-01 (CONTRACT QUANTITIES OTHER THAN DDCMIS ITEM)	5 OF 15	C	C CONTRACT QUANTITIES FOR UPS								C CONTRACT QUANTITIES FOR UPS							
					1.02.00								1.02.00							
					S . N o	U PS Re fer ence	Min Ste ady Sta te KV A rati ng at 50 De g C	Em plo yer' s Lo ad - KV A	UP S Lo cati on	Quantity		Confi gurati on	S . N o	U PS Re fer ence	Min Ste ady Sta te KV A rati ng at 50 De g C	Em plo yer' s Lo ad - KV A	UP S Lo cati on	Quan tity	Confi gurati on	
										Unit	Co mm							Unit	Com m	
1	U PS - C P U-01	*	NA	CP U Re ge ner ati on CR		1	B	1	U PS - C P U-01	*	NA	CP U Re ge ner ati on CR		1	B					
2	U PS - T G(H Y)-03	*	NA	Hy dro ge n Ge ner ati on Pla nt		1	C	2	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED					

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89.	SECTION VI/A	APPENDIX - I TO SUB-SECTION -IIC-01 (CONTRACT QUANTITIES OTHER THAN DDCMIS ITEM)	12 OF 15	E	<u>Table: SWAS-II</u> Note: Process parameters and location of tapping points shall be furnished during detailed Engineering	NOT USED

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90.	SECTION VI/A	APPENDIX - I TO SUB-SECTION -IIC-01 (CONTRACT QUANTITIES FOR DDCMIS ITEM)	6 OF 7	4.00.00	PLC based Control Systems				NOT USED
					SI No.	Area	Description of Control system	Quatity	
					1	Hydrogen Generation Plant(as applicable)	Refer scope II C-01 Control & Instrumentation system, Section-VI,PART-A	01 Set	
					2	Air Conditioning &Ventilation System for Service Building	Refer scope II C-01 Control &Instrumentation system, Section-VI,PART-A	01 Set	

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91.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	11 of 33	2.08.00 (f)	For the instruments which are proposed to be used for PG test as indicated in the tender P&IDs at Part-E, suitable sharing scheme for PG test field signals shall be provided using splitters etc. such that for each field signal entering the marshalling cabinet following two outputs are available: i) to the corresponding control cabinet of the marshaling cabinet for use in normal control purpose. ii) to a separate set of TB's for use in PG test purpose in a separate wall mounted Junction Box (having ways corresponding to the number of PG test instruments plus 10% spare) in the CER for further connection to a separate PG test evaluation system/cabinet. The exact methodology of sharing/splitting of signals shall be finalised during detailed engineering. The wall mounted Junction Box, cables, wiring, laying and termination up to the junction box shall be in the scope of this package.	NOT USED

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92.	SECTION VI/ PART A	A-1	12 of 14	7.6	The other C&I systems offered for this package shall meet the following. a) SWAS and Vibration Monitoring system offered for this package shall be same or of same series which should have been in successful operation for a period of not less than one(1) year in at least one(1) unit of rating 200MW or above in a power station. b) 24 V DC modular charger offered for this package telecommunication application. Notes:- (A) Control system for BOP-C&I-TG and STG integral controls application(s) referred in Para 7.1, 7.2, 7.3, 7.4 and 7.5 means following :- (i) Control system for BOP-C&I-TG shall include Modulating control for feed water / Condensate Cycle and Binary Control of the auxiliaries for Turbine generator (TG) for coal fired units. (ii) Control system for STG integral controls shall include Steam Turbine Electro-hydraulic control & Turbine Protection system.	The other C&I systems offered for this package shall meet the following. a) ~~SWAS and~~ Vibration Monitoring system offered for this package shall be same or of same series which should have been in successful operation for a period of not less than one(1) year in at least one(1) unit of rating 200MW or above in a power station. b) 24 V DC modular charger offered for this package Telecommunication application. c) Isolation valves, Blow down Valves, Coolers & Automatic Pressure reducer valves in Primary Rack, Thermal shut-off valves and Analysers of SWAS system offered for this package shall be same or of same series which should have been in successful operation for a period of not less than one (1) year in at least one (1) supercritical unit of rating 660MW or above in a power station. Notes:- (A) Control system for BOP-C&I-TG and STG integral controls application(s) referred in Para 7.1, 7.2, 7.3, 7.4 and 7.5 means following :- (i) Control system for BOP-C&I-TG shall include Modulating control for feed water / Condensate Cycle and Binary Control of the auxiliaries for Turbine generator (TG) for coal fired units. (ii) Control system for STG integral controls shall include Steam Turbine Electro-hydraulic control & Turbine Protection system.

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93.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	18 of 33	4.00.00, Notes-6	For measurement of level of tanks/vessels/sumps containing oil (except applications defined under Note-1(iv) above), chemicals or water, Ultrasonic type level transmitters shall be provided	For measurement of level of tanks/vessels/sumps containing oil (except applications defined under Note-1(iv) above) or chemicals ~~or water~~ , Ultrasonic type level transmitters shall be provided
94.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	14 of 33	4.00.00	4.00.00 MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) (a) All the primary ...sections. However, measuring instruments which have been indicated in the tender PID as connected to BOP-C&I/ SG-C&I (being procured by employer under separate package) are excluded from Contractor's scope of supply. In case additional instruments are required as per the standard & proven practice of the Contractor/ sub-vendor, the same shall be supplied by the Contractor within this contract.	4.00.00 MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) (a) All the primary ...sections. However, measuring instruments (other than temperature measurements) which have been indicated in the tender PID as connected to BOP-C&I/ SG-C&I (being procured by employer under separate package) are excluded from Contractor's scope of supply. For scope of temperature measurements refer (c) below. In case additional instruments are required as per the standard & proven practice of the Contractor/ sub-vendor, the same shall be supplied by the Contractor within this contract.

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95.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	3 of 33	1.11.02	Open loop controls: For open loop control is envisaged. Notes: A. The control system and devices (Actuators, instruments) shall be conventional for following areas/ application: I. TG Integral: a. STG Integral Control and Protection System. b. Protection and governing controls of BFP Turbine. c. HP/LP Bypass system controls and protection.	Open loop controls: For open loop control is envisaged. Notes: A. The control system and devices (Actuators, instruments) shall be conventional for following areas/ application: I. TG Integral: a. STG Integral Control and Protection System. b. Protection and governing controls of BFP Turbine. c. HP/LP Bypass system controls and protection. II. Instruments used for PG test shall be conventional.
96.	SECTION VI/ PART-E	P&ID of Equipment Cooling Water System (9915-110-POM-A-025)			General Notes: 1. Scheme for... 9. ...generator supplier.	General Notes: 1. Scheme for... 9. ...generator supplier. 10. BOP C&I may please be read as BOP-C&I-TG

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97.	SECTION VI/A	IIC CONTROL & INSTRUMENTATION	31 of 33	17.09.00	The Contractor shall depute ... of the unit etc.	The Contractor shall depute ... of the unit etc. For erection and commissioning of specified actuators, qualified and experienced engineers of actuator manufacturer shall be deputed at site. After successful commissioning of actuators, minimum one qualified and experienced engineer of main package supplier/ actuator manufacturer shall be continuously available at site up to COD (Commercial operation declaration) of complete plant, 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 non-intrusive actuators along with fieldbus protocol and interfacing with DDCMIS.
98.	SECTION VI/P ART-A & PART-B	IIC-01, Part-A and its Appendices, IIIC-01 to IIIC-19 of Part-B			ANNUAL MAINTENANCE CONTRACT (AMC)	Wherever ANNUAL MAINTENANCE CONTRACT (AMC) is used in the C&I chapters of specification (IIC-01, Part-A and its Appendices, IIIC-01 to IIIC-19 of Part-B), it is to be read as ANNUAL MAINTENANCE SERVICES (AMS)
99.	SECTION VI/P ART-B	Annexure-IIIC-02K			Replace existing Annexure-IIIC-02K (General requirements for Fieldbus) with new Annexure.	New Annexure-IIIC-02K (General requirements for Fieldbus) enclosed.
100.	VI/A	IIC	27 of 33	13.00.00	STEAM & WATER ANALYSIS SYSTEM (SWAS)	Clause 13.00.00 and all its sub clauses replaced as per

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						attached C&I-Annexure-I.
101.	VI/B	IIIC-13	1 to 9		STEAM AND WATER ANALYSIS SYSTEM (SWAS)	Chapter IIIC-13 is replaced as per attached C&I-Annexure-II.

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102.	VI/ PA RT- B	A-1	13 OF 14	8.0	PROVENNESS CRITERIA FOR CIVIL AND STRUCTURAL WORKS 8.1 Bidder or its agency should have in past executed civil and structural works of 500 MW or higher capacity coal based/Lignite based power plant including piling, Main power house building and Foundation for Turbo-generator. 8.2 Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 8.1. The agency being engaged for a particular work should have in the past executed such works of 500 MW or higher capacity plant. 8.3 In case Bidder or its agency do not meet the requirements at 8.1 and the Bidder proposes to engage agency (ies) for civil & structural works on work volume basis, Bidder or its agency (ies) should have executed such works in the past and the annual rate of execution in the reference works should not be less than eighty percent (80%) of the asking rate of such works, (structural steel fabrication & erection and RCC) for which it is being engaged. 8.4 Successful Bidder shall finalize the agency (ies) for each work in consultation with Engineer-in-charge at site before engaging them. 8.5 a) Bidder or its design agency (ies) should have carried out the design and detailed engineering of Main plant building of coal based/Lignite based power	PROVENNESS CRITERIA FOR CIVIL & STRUCTURAL WORKS 8.1 Bidder or its agency should have executed civil and steel structural works of 500 MW or higher capacity coal based/Lignite based power plant including, Main power house building and Foundation for Turbo-generator. 8.2 In case Bidder or its agency do not meet the requirements at 8.1 and the Bidder proposes to engage agency (ies) for concrete & steel structural works, the proposed agency (ies) should fulfill the following criteria: a) For concrete works, Bidder or its agency should have executed concrete works of TG building/Bunker building of 500 MW or higher capacity coal based/Lignite based power plant/ TG Building of Nuclear Power Plant b) For Steel Structural works, Bidder or its agency should have executed steel structural works of TG building/Bunker building of 500 MW or higher capacity (coal based/Lignite based) power plant / TG Building of Nuclear Power Plant / Steel Melting Shop/Proportioning Bin Building of Steel Plant In case, Bidder proposes to engage more than
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					plant of 500 MW or higher capacity. b) For Foundation for Turbo-generator, Bidder or its design agency should have carried out design & detailed engineering of at least one foundation for Turbogenerator (with or without Vibration Isolation system as offered by the Bidder). The design agency (ies) proposed by the Bidder shall be subject to Employer's approval.	one agency for the works mentioned at para 8.2 (a) or 8.2 (b) above, Bidder shall do so on work volume basis. The annual rate of execution in the reference works should not be less than eighty percent (80%) of the asking rate of such works, for which it is being engaged. 8.3 For piling works, Bidder or its agency(ies) should have executed piling works (minimum 600mm diameter) using rotary hydraulic rigs. Bidder shall engage agency (ies) for piling works on work volume basis. The annual rate of execution in the reference works should not be less than eighty percent (80%) of the asking rate. 8.4 Bidder should have executed the reference works within the preceding seven (7) years reckoned as on date of Techno-Commercial bid opening. 8.5 Successful Bidder shall finalize the agency (ies) for each work in consultation with Engineer-in-charge at site before engaging them. 8.6 a) Bidder or its design agency (ies) should have carried out the design and detailed engineering of Main plant building of coal based/Lignite based power plant of 500 MW or higher capacity.	
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						b) For Foundation for Turbo-generator, Bidder or its design agency should have carried out design & detailed engineering of at least one foundation for Turbo-generator (with or without Vibration Isolation system as offered by the Bidder). The design agency (ies) proposed by the Bidder shall be subject to Employer's approval.
103.	VI/ PA RT- A	III	6 OF 6	9.00.0 0	TERMINAL POINTS	A. TERMINAL POINTS 9.00.00 CIVIL 9.01.00 Pipe/Cable Trestles – The terminal points of Pipe/Cable trestles shall be as indicated in tender drawing 9915-999-POM-F-006. 9.02.00 Boiler-TG Building Interconnection – Terminal Point shall be C-row column. Bracket, Sliding bearing and Interconnecting platform shall be in SG vendor scope. Other Terminal Points shall be as marked in GLP, tender drawings and as specified in Technical Specification

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

104.	VI/ PA RT- A	III	6 OF 6	11.03. 00	-----	B- EXCLUSIONS 12.00.00 CIVIL a) Plant Boundary Wall. b) Railway Siding c) Development of Green Belt d) Ash Pond
105.	VI/ PA RT- B	D-01	2 OF 142	1.01.0 0	This specification is to cover, survey works , site levelling works,..... Industrial structures like Petro/Chemical/Refinery/Cement etc. Bidder shall obtain the approval of detailing agency for making fabrication drawings before engaging them.	This specification is to cover, survey works , site levelling works,..... Industrial structures like Petro/Chemical/Refinery/Cement etc. Bidder shall obtain the approval of detailing agency for making fabrication drawings before engaging them. However, fabrication drawings are not subject to approval by the Owner.

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106.	VI/ PA RT- B	D-01	5 OF 142	3.07.0 0	As-built drawings with quantities of various items of work system wise, building wise, structure wise, etc. duly certified by Site after execution of work for information/record.	Quantities for structural steel grade wise, concrete (PCC/RCC) grade-wise, reinforcement steel, form work, excavation, piling diameter-wise, metal decking/cladding sheets shall be provided in As-Built drawings duly certified by Site after execution of work for information/record. These quantities shall be provided system wise, building wise, structure wise, etc. Wherever applicable, quantities below ground and above ground shall be provided separately.
107.	VI/ PA RT- B	D-01	8 OF 142	5.01.0 0 i)	All the buildings and site development including landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rain water harvesting scheme for the project and obtaining approval of the scheme from Central Ground Water Board is in Bidder's Scope.	DELETED
108.	VI/ PA RT- B	D-01	8 OF 142	5.01.0 0 k)	For Control Rooms in MPH dry wall construction technology shall be incorporated. Control room shall be designed as designer control room with ACP Cladded wall panelling for housing LVS.	For Control Rooms, CER, UPS Charger Room area in MPH dry wall construction technology shall be incorporated. Control room shall be designed as designer control room with ACP Cladded wall panelling for housing Large Video Screens.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

109.	VI/ PA RT- B	D-01	8 OF 142	5.01.0 0 m)	Architectural Concepts &Design m) Landscape Development There shall be comprehensive landscape development in entire plant area to create a pleasant and healthy environment. The scope of work for landscape and horticulture work shall include supply and planting of trees, shrubs, hedges/edges/borders, grass lawn around different areas, and plantation along Patrol roads etc.	Architectural Concepts &Design m) Landscape Development There shall be comprehensive landscape development in entire plant area under the scope of this package to create a pleasant and healthy environment. The scope of work for landscape and horticulture work shall include supply and planting of trees, shrubs, hedges/edges/borders, grass lawn around different areas, and plantation along Patrol roads etc.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

110.	VI/ PA RT- B	D-01	9/10 OF 142	5.02.0 1	(I) Salient Features Main Powerhouse shall..... as per IS 15916. The roof system in turbine bay shall comprise a structural steel girder (open web or solid web) for the entire bay width. The roof slab shall consist of 40mm thick (min.) RCC slab supported on profiled metal deck sheet. The metal deck shall be..... around roof of main plant building. All edges of openings shall have edge protection angles (minimum ISA 75x75x6) and handrails with hand posts (Hand post spacing 1.50m maximum)(Hand post spacing 1m maximum).	(I) Salient Features Main Powerhouse shall..... as per IS 15916. The roof system in turbine bay shall comprise a structural steel girder (open web or solid web) for the entire bay width. The roof slab shall consist of 40mm thick (min. above the crest of metal deck sheet) RCC slab supported on profiled metal deck sheet. The metal deck shall be..... around roof of main plant building. All edges of openings shall have edge protection angles (minimum ISA 75x75x6) and handrails with hand posts (Hand post spacing 1m maximum).

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

111.	VI/ PA RT- B	D-01	10 OF 142	5.02.0 1	(ii) Design Concept Main Powerhouse shall..... dead weight. The Main columns in A, B &C rows of Main Power House Building shall be built-up I sections. Rolled sections/ I sections with additional flange plates shall not be acceptable for main columns & auxiliary columns. The roof truss to column connection shall be bolted connection using high strength bolts (grade 8.8/ IS 1367). The roof truss of Turbine Hall shall be adequately braced in plan using Tie level and rafter level bracings. The longitudinal bracing shall comprise a pair of members connected to the column flanges and detailing shall be adequate to restrain the entire column cross- section. Minimum gusset plate thickness for bracings shall be 12mm. 	(ii) Design Concept Main Powerhouse shall..... dead weight. The Main columns in A, B &C rows of Main Power House Building shall be built-up I sections. Rolled sections/ I sections with additional flange plates shall not be acceptable for main columns & auxiliary columns. The roof girder (open web or solid web) to column connection shall be bolted connection using high strength bolts (grade 8.8/ IS 1367). The roof girder of Turbine Hall shall be adequately braced in plan using Tie level and rafter level bracings. The longitudinal bracing shall comprise a pair of members connected to the column flanges and detailing shall be adequate to restrain the entire column cross-section. Minimum gusset plate thickness for bracings shall be 12mm.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

112.	VI/ PA RT- B	D-01	10 OF 142	5.02.0 1	Main Power House iii. Architectural Features This building shall be of Structural Steel Framed structure and shall be completely Covered with external cladding and RCC roof. The The external vertical face (herein stated as 'C' row) facing (& adjacent to) the Boiler area shall be completely covered upto the Deaerator floor level with vertical cladding comprising 3.0m high brick wall on ground floor followed by either single skin metal sheeting with runners or brick wall sandwiched with single skin metal sheeting on external face (for all floors requiring 4 hours of fire rating e.g.cable spreader room, ventilation/ air washer room, AHU Rooms and air conditioned areas) Internal steel columns in Air Conditioned Area of Main Power House Building shall be encased with Aluminium Composite Panelling up to false ceiling	Main Power House iii. Architectural Features This building shall be of Structural Steel Framed structure and shall be completely Covered with external cladding and RCC roof. The The external vertical face (herein stated as 'C' row) facing (& adjacent to) the Boiler area shall be completely covered upto the Deaerator floor level with vertical cladding comprising 3.0m high brick wall on ground floor followed by either single skin metal sheeting with runners or brick wall sandwiched with single skin metal sheeting on external face (for all floors requiring 2 hours of fire rating e.g.cable spreader room, ventilation/ air washer room, AHU Rooms and air conditioned areas) Internal steel columns in Air Conditioned Area of Main Power House Building (CCR, CER, UPS Charger Room, SWAS Room, Conference Room, Programmer's Room etc.) shall be encased with Aluminium Composite Panelling up to false ceiling

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

	VI/ PA RT- B	D-01	14 OF 142	5.02.0 3	Pipe & Cable Galleries Salient Features	Pipe & Cable Galleries Salient Features
113.					The Pipe- Cable Gallery shall be Structural Steel Superstructure with Steel Truss (Lattice Girder) having a general span of 15.0m/20.0m. However, trestles for pipe and cable galleries shall be either of structural steel or concrete (Pre Cast) construction. Design, fabrication/ manufacturing of precast structural members like column & beams, handling/erection and jointing thereof shall be done as per IS 15916. The width of the Gallery shall vary depending on the functional requirement. A walkway of minimum width 600mm shall be provided along the Cable Trays supporting floor of the gallery. The walkway shall comprise 40mm thick MS grating and 1.0m high handrail made of 32NB MS pipes. Plan bracings The foundation for Pipe-Cable gallery trestles shall comprise RCC pedestals with footings. The footing base shall rest on virgin soil. In case virgin soil depth is high, the gap shall be filled with PCC (M10 grade). The grade of concrete for RCC footing & pedestals shall be M25. The structural trestles shall not be supported on paving RCC slab.	The Pipe- Cable Gallery and their trestles shall be of Structural Steel Superstructure with Steel Truss (Lattice Girder) having a general span of 15.0m/20.0m. The width of the Gallery shall vary depending on the functional requirement. A walkway of minimum width 600mm shall be provided along the Cable Trays supporting floor of the gallery. The walkway shall comprise 40mm thick MS grating and 1.0m high handrail made of 32NB MS pipes. Plan bracings The foundation for Pipe-Cable gallery trestles shall be open foundation or pile foundation depending upon bearing capacity requirements. For specification regarding open and pile foundations, clause. 7.00.00 is to be referred. The grade of concrete for RCC footing/pilecaps & pedestals shall be M25. The structural trestles shall not be supported on paving RCC slab.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

114.	VI/ PA RT- B	D-01	17 OF 142	5.03.0 1.07	Minimum thickness of foundation slab / raft and base slab of all liquid retaining tanks / pits shall not be less than 250 mm. Minimum thickness of all elements of RCC liquid retaining / conveying structures (except effluent drains, launders and aerator waste slab) shall be 200mm. Effluent drains (depth more than 500mm), aerator waste slab and launders shall have minimum element thickness of 150mm.	Minimum thickness of foundation slab / raft and base slab of all liquid retaining tanks / pits shall not be less than 250 mm. Minimum thickness of all other elements of RCC liquid retaining / conveying structures (except effluent drains, launders and aerator waste slab) shall be 200mm. Effluent drains (depth more than 500mm), aerator waste slab and launders shall have minimum element thickness of 150mm.
115.	VI/ PA RT- B	D-01	17 OF 142	5.03.0 1.08	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter. Edge protection angles shall be provided as specified elsewhere.	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter rods or 6 mm thick flats. Edge protection angles shall be provided as specified elsewhere.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

116.	VI/ PA RT- B	D-01	18 OF 142	5.03.0 2	Acid/Alkali..... in case of walls nearby. Alum/Lime Storage area and first floor of Chemical House : One coat of bitumen primer followed by 12mm thick bitumastic layer, 20 mm thick A.R. tiles, 6 mm thick underbed of potassium silicate mortar, 6mm thick pointing of joints of tiles with acid /alkali resistant epoxy /furane mortar up to a depth of 20 mm and bitumastic end sealing. Alum solution preparation tank: The wall shall be provided with one coat of bitumen primer followed by 12 mm thick bitumastic layer, 75 mm thick A.R. tiles, 6 mm thick underbed by potassium silicate mortar, pointing of joints of tiles with acid / alkali resistant epoxy / furane mortar upto a depth of 20 mm and bitumastic end sealing. The floor shall be	Acid/Alkali..... in case of walls nearby. The floor shall be
117.	VI/ PA RT- B	D-01	22 OF 142	5.06.0 2	Single Lane Roads All access roads to all buildings / facilities / structures, road approaches / connections, access roads to liquid fuel storage areas and other equipment areas where access is necessary from inspection, operation and maintenance point of view and all roads inside the switchyard shall be single lane roads.	Single Lane Roads All access roads to all buildings / facilities / structures, road approaches / connections, access roads to other equipment areas where access is necessary from inspection, operation and maintenance point of view and all roads inside the switchyard shall be single lane roads.

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

118.	VI/ PA RT- B	D-01	22 OF 142	5.06.0 3	Patrol Roads All patrol roads along the boundary wall from the centre line of the boundary wall.	DELETED

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

119.	VI/ PA RT- B	D-01	23 OF 142	5.07.0 0	AREA PAVING RCC paving of minimum 150 mm thick with M25 grade concrete, ... For heavy duty paving/ passage, reinforcement of the RCC paving shall consist of minimum 10mm diameter bars @ 200 mm c / c in both directions at the centre of the slab. Paving areas shall be provided with the metallic hardener floor finish as specified elsewhere in the specification. Entire area as defined in Part-A (Sub section-II D) shall be provided with RCC paving. Passages shall be provided inside the main plant block connecting to the outer periphery road to have access to the various facilities/buildings. These passage areas shall be provided with heavy duty paving for movement of heavy vehicles. The top surface of the passages shall be finished with 50 mm thick metallic hardener topping. Lightly loaded areas such as corridors below trestle and other areas in the main plant block where no heavy traffic movement is envisaged shall be provided with interlocking concrete block paving with RCC concrete blocks of minimum M35 grade and minimum 80 mm thickness underlain by 200mm thick with 63 mm and down aggregate with interstices filled with selected moorum/ non-expansive soil. All other areas inside the Main plant block shall be provided with normal duty paving without metallic hardener topping. Suitable open RCC drains with Heavy duty	AREA PAVING RCC paving of minimum 150 mm thick with M25 grade concrete, ... For heavy duty paving/ passage, reinforcement of the RCC paving shall consist of minimum 10mm diameter bars @ 200 mm c / c in both directions at the centre of the slab. Paving areas shall be provided with the metallic hardener floor finish as specified elsewhere in the specification. Passages shall be provided inside the main plant block connecting to the outer periphery road to have access to the various facilities/buildings. These passage areas shall be provided with heavy duty paving for movement of heavy vehicles. The top surface of the heavy duty passages shall be finished with 50 mm thick metallic hardener topping. Wherever Area paving is stipulated in Scope of Work / Technical Specification, RCC paving shall be provided. However, corridors below pipe/cable trestles where no traffic movement is envisaged and corridor over buried fire water pipes shall be provided with interlocking concrete blocks of minimum M35 grade and minimum 80 mm thickness underlain by 20mm thick layer of sand followed by 200mm thick 63 mm and down aggregate with interstices filled with selected moorum/ non-expansive soil. All other areas inside the Main plant block shall

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					electro forged GI grating cover. Sewer lines (Cast Iron), interconnected by sewer manholes (RCC) at regular intervals (not exceeding 30 meter centre to centre) shall be provided to dispose off sewage from main plant block.				be provided with normal duty paving without metallic hardener topping. Suitable open RCC drains with Heavy duty electro forged GI grating cover. Sewer lines (Cast Iron), interconnected by sewer manholes (RCC) at regular intervals (not exceeding 30 meter centre to centre) shall be provided to dispose off sewage from main plant block.			
120.	VI/ PA RT- B	D-01	27 OF 142	6.02.0 2 A) vii)	vi)	Roof (where no equipment are located)	0.15		vi)	Roof	0.15	
					vii)	Roof (where equipment are located)	0.5					

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121.	VI/ PA RT- B	D-01	30 OF 142	6.03.0 2 I)	The Structures shall be Designed for most unfavorable Combination of Dead Loads, Imposed Loads, Equipment Loads, Piping / Cables / Ducts Loads, Wind / Seismic Loads, Temperature Loads, Ash Loads, and other applicable Loads without exceeding the Permissible Stresses.	The Structures shall be designed for most unfavorable Combination of Dead Loads, Imposed Loads, Equipment Loads, Piping / Cables / Ducts Loads, Wind / Seismic Loads, Temperature Loads, Ash Loads, and other applicable Loads without exceeding the Permissible Stresses. No reduction in equipment loads, piping loads, ash loads and loads due to other permanent facilities shall be considered for calculation of seismic weight of the building/structure and for load combinations thereof.

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122.	VI/ PA RT- B	D-01	33 OF 142	6.03.1 1 (c)	If RCC floor/roof is assumed to act as diaphragm, transmitting lateral loads to braced bays, it shall be provided with shear connectors. However, whenever large / more number of cut-outs are provided in the floor slab, horizontal floor bracings shall be provided below slab to transfer horizontal force to columns without considering diaphragm action from slab.	If RCC floor/roof is assumed to act as diaphragm, transmitting lateral loads to braced bays, it shall be provided with shear connectors. The spacing of shear anchor studs on structural beams shall be minimum of the spacing required for i) Restraining the compression flanges of beams and ii) Transfer of the horizontal shear at floor/roof to the supporting beams. However, whenever large / more number of cut-outs are provided in the floor slab, horizontal floor bracings shall be provided below slab to transfer horizontal force to columns without considering diaphragm action from slab.

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123.	VI/ PA RT- B	D-01	36 OF 142	6.03.2 4	The founding depth / cut off level of piles shall be decided based on functional requirement. Where structural steel columns specified elsewhere in this specification. Further the gusset plate and foundation bolts are to be encased in concrete up to the top of the paving level. For outdoor structural steel columns, about 300 mm height of steel columns above the top of paving level shall be provided with at least 125 mm thick encasement with minimum reinforcement to prevent corrosion of the steel columns from surface water	The founding depth / cut off level of piles shall be decided based on functional requirement. Where structural steel columns specified elsewhere in this specification. Further, the indoor structural steel columns, gusset plates and foundation bolts shall be encased in concrete (minimum 125mm thick) up to 125mm above the top of the paving level. For outdoor structural steel columns (columns of pipe cable trestles) , 300 mm height of steel columns above the top of paving level shall be provided with at least 125 mm thick encasement with minimum reinforcement to prevent corrosion of the steel columns from surface/ rain water.
124.	VI/ PA RT- B	D-01	36 OF 142	6.03.2 4 (a) Last para	No foundation shall rest on filled up soil. Loose soil if any below foundation is to be removed and replaced with PCC of grade M7.5.	This para stands deleted

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

125.	VI/ PA RT- B	D-01	36 OF 142	6.04.0 1 (c)	All steel structures shall be designed by following basic design criteria in ISO 12944 Part 3. However, where it is not feasible to follow the design criteria given in ISO 12944 Part 3 where the steel surface are inaccessible for application of protective coating, corrosion allowance of 1.5 mm shall be kept in thickness(over the design thickness) of structural steel members for Khurja Super Thermal Power Project.	All steel structures shall be designed by following basic design criteria in ISO 12944 Part 3. Minimum thickness of metal for any structural steel elements shall be not less than 6 mm where steel is fully accessible for cleaning and repainting and where it is feasible to follow design criteria given in ISO 12944 part 3. However, where steel surfaces are inaccessible for cleaning and repainting or where it is not feasible to follow design criteria given in ISO 12944 part 3, corrosion allowance of 1.5 mm shall be kept in thickness (over the design thickness or 6mm, whichever is more). Minimum thickness of tubular/ hollow steel sections conforming to IS 4923 shall be 4.0 mm, provided the ends of such steel sections are effectively sealed.
126.	VI/ PA RT- B	D-01	38 OF 142	6.04.0 8	All structural steel members in switchyard (excluding fencing and gate) shall be hot dip galvanised as specified elsewhere	DELETED

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127.	VI/ PA RT- B	D-01	39 OF 142	7.01.0 0	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-I 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.	Owner has carried out preliminary geotechnical investigation in the proposed area. Available bore logs of the area along with laboratory test results (including chemical test results) are enclosed at Annexure-C and electrical resistivity test results are enclosed at Annexure-G 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. <i>(Refer Appendix-A and B to this amendment for chemical test results)</i>
128.	VI/ PA RT- B	D-01	41 OF 142	7.02.0 2 (i)	During design, the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be as per approved geotechnical report and shall be limited to the values as furnished in Table-1 . The ground improvement scheme shall be approved by owner before execution.	During detailed engineering, the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be lower of the two values i.e. as per approved geotechnical report and as per the values furnished in Table-1 . The ground improvement scheme shall be approved by owner before execution.
129.	VI/ PA RT- B	D-01	42 OF 142	7.02.0 3	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.	Following structures are to be placed on pile foundation: Main Power house including Control room, TGs, Service Building, Transformer foundations (Power Transformers (GT, ST, UT, UAT) in transformer yard) , any other heavily loaded structure etc.

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130.	VI, PA RT- B	D-01	43 of 142	7.02.0 3 (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 as per approved geotechnical report & shall be limited to following values:	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 least of the three values i.e. as per approved geotechnical report, as per the values furnished in following table and pile capacity achieved in pile load tests.
131.	VI/ PA RT- B	D-01	47 OF 142	7.03.0 0	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	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 and values furnished below. Contractor shall carry out chemical analysis during detailed geotechnical investigation and required treatment shall be provided based upon higher of the values obtained in detailed geotechnical investigation carried out by contractor or as given in Annexure-C.
132.	VI/ PA RT- B	D-01	53 OF 142	8.01.0 2.16	All building shall be design to take care of Rain Water harvesting & ground water recharging.	All the buildings and site development including landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rain water harvesting scheme for the buildings, structures, facilities in Bidder's scope and obtaining approval of the scheme from Central Ground Water Board is in Bidder's Scope.

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133.	VI/ PA RT- B	D-01	56 OF 142	8.02.0 3 (e)	Ultrasonic Testing Ultrasonic pulse velocity test shall be carried out for TG top deck including TG Columns & BFP top decks to ascertain the homogeneity and integrity of concrete. In general, grid spacing of 1.0m to 1.5m may be adopted for carrying out the UPV testing. In addition, additional cubes (at the rate of one cube per 150 Cum of concrete subject to a minimum of six cubes) shall be taken to carry out Ultrasonic Pulse velocity (UPV) testing on the cubes, to serve as reference UPV values. Testing shall be done as per IS13311 (Part-1). In case of any defect, the Bidder shall rectify the defects suitably using cement/epoxy grout, etc.	Ultrasonic Testing Ultrasonic pulse velocity test shall be carried out for TG top deck including TG Columns & BFP top decks to ascertain the homogeneity and integrity of concrete. In general, grid spacing of 1.0m to 1.5m may be adopted for carrying out the UPV testing. In addition, additional cubes (at the rate of one cube per 150 Cum of concrete subject to a minimum of six cubes) shall be taken to carry out Ultrasonic Pulse velocity (UPV) testing on the cubes, to serve as reference UPV values. Testing shall be done as per IS13311 (Part-1). In case of any defect, the Bidder shall rectify the defects suitably using cement/epoxy grout, etc. Wherever block type foundations are provided for machine foundations such as BFPs, UPV testing of foundation concrete is not required.
134.	VI/ PA RT- B	D-01	61 OF 142	8.07.0 1.1 b)	All low hydrogen electrodes shall be baked and stored before use as per manufacturer recommendation. The electrodes shall be rebaked at 2500°C - 3000°C for one hour and later on cooled in the same oven to 1000C. It shall be transferred to an holding oven maintained at 600°C - 700°C. The electrodes shall be drawn from this oven for use.	All low hydrogen electrodes shall be baked and stored before use as per manufacturer recommendation. The electrodes shall be rebaked at 250°C - 300°C for one hour and later on cooled in the same oven to 100°C. It shall be transferred to an holding oven maintained at 60°C - 70°C. The electrodes shall be drawn from this oven for use.

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135.	VI/ PA RT- B	D-01	64, 65 OF 142	8.07.0 1.6	Inspection and Testing a) Fillet Welds i) All fillet welds shall be checked for size and visual defects. ii) Macroetch examination on production test coupons for main fillet weld with minimum one joint per built up beam, column and crane girder, etc. iii) 25% weld length of tension members of crane girder shall be subjected to dye-penetration test. iv) On all other welds, dye-penetration test on 5% of weld length with minimum 300mm at each location shall be carried out. b) Butt Welds i) 100% visual examination. ii) Dye penetration test on all butt welds after back gouging shall be carried out. Mechanical testing of production test coupons - minimum one joint/built up beam, column and crane girder. The engineer may reduce the frequency of the test, after getting consistently satisfactory results of initial 10 tests. iv) 100% radiography test on butt welds of tension flange (bottom flange) of crane girder and bunker supporting girders. All other butt welds shall be subjected to radiography test on 10% of weld length of each welder. c) Dimensional Tolerance and Acceptance Criteria of Welds i) Every first and further every 10th set of identical	Inspection and Testing a) Fillet Welds Refer clause 11.1.5.9 of Part B Sub Section E-47 of Technical Specification b) Butt Welds Refer clause 11.1.5.9 of Part B Sub Section E-47 of Technical Specification c) Dimensional Tolerance and Acceptance Criteria of Welds Refer clause 11.1.5.9 of Part B Sub Section E-47 of Technical Specification
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					structure shall be checked for control assembly at shop before erection. ii) All structures, components/members shall be checked for dimensional tolerance during fabrication and erection as per IS:7215 and IS:12843 respectively. iii) Dry film thickness after painting shall be checked by using elchometer. Acceptance criteria of NDTs on welds shall be as per AWS D-1.1 (Dynamically loaded structures - Tension welds).	
136.	VI/ PA RT- B	D-01	73 OF 142	9.04.0 6	12mm/20mm/... bituminastic end sealing. Requirements for acid/ alkali resistant flooring and lining for different areas shall be as given Table-A enclosed at the end of this specification. Battery Room in all buildings shall be provided with acid/ alkali resistant tiles on flooring & dado 1200mm high.	12mm/20mm/... bituminastic end sealing. Battery Room in all buildings shall be provided with acid/ alkali resistant tiles on flooring & dado 1200mm high.
137.	VI/ PA RT- B	D-01	74 OF 142	9.04.0 8	For pathway, chequered and designed concrete tiles minimum 22 mm thick, 200x200 mm size conforming to IS: 13801 of approved shade and colour shall be used. 1000 wide pathways shall be provided for maintenance on rooftops of all buildings.	For pathway on roof , chequered and designed concrete tiles minimum 22 mm thick, 200x200 mm size conforming to IS: 13801 of approved shade and colour shall be used. 1000 wide pathways shall be provided for maintenance on rooftops, all around the parapet wall and to access equipment on roof of all buildings.

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138.	VI/ PA RT- B	D-01	75 OF 142	9.06.0 2	Roof of all buildings having RCC framework shall have cast-in-situ pedestal of minimum 30 cm height from the finished roof to facilitate maintenance of roof treatment in future.	Deleted
139.	VI/ PA RT- B	D-01	75,76 OF 142	9.06.0 5	Roof of the specific buildings shall conform to minimum 3 star GRIHA Rating shall be rubbed and polished upto three cuts complete. Skirting upto 150 mm along the parapet walls shall be provided in the same manner.	Roof of the specific buildings shall conform to minimum 3 star GRIHA Rating shall be rubbed and polished upto three cuts complete. Skirting upto 150 mm along the parapet walls shall be provided in the same manner. Roof Water Profing shall be done as per Clause no.9.06.06.

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140.	VI/ PA RT- B	D-01	76 OF 142	9.06.0 6	Roof Water Proofing Roof water proofing treatment shall be as follows: a) For roofs having structural slope: Top surface of sloped R.C.C. slab shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid. The elastomeric shall comprise of high solid content liquid applied urethane laid over reinforcing layer of polyscrim cloth or non woven geo-textile. The top of the elastomeric membrane shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also. b) For roofs having no structural slope: Screed concrete mix (1:2:4) grading having minimum 25mm thickness at the lowest point of the slope shall be laid over R.C.C. slab and shall be laid as per the slope specified elsewhere in the specification. Top surface of grading underbed shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid and top of the elastomeric membrane shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of	Roof Water Proofing Roof water proofing treatment shall be as follows: a) For roofs having structural slope: Top surface of sloped R.C.C. slab shall be finished with 15mm thick cement plaster (1:4). Roof shall be provided with roof water proofing treatment using high solid content liquid applied elastomeric water proofing membrane laid over reinforcing layer of polyscrim cloth or non woven geo-textile, with separate wearing course as per ASTM - C-836 & 898. Thickness of the membrane shall be 1.5mm (min.). This treatment shall include application of polymerised mastic over the roof to achieve smooth surface and primer coat. Wearing course on the top of membrane shall consist of 25mm thick PCC (1:2:4) cast in panels of maximum 1.2 x 1.2m size and reinforced with 0.56mm dia galvanised chicken wire mesh and sealing of joints using sealing compound/elastomeric water proofing membrane. Chequered concrete tile flooring 22 mm (min.) thick of approved colour and shade conforming to IS: 13801 shall be provided for path way of 1 m. width for access of personnel and handling of equipment and for the entire area of the roof where equipment like AC / Ventilation plant, cooling towers, etc. are provided in

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					roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also	place of PCC wearing course. Equipment shall be installed on raised pedestal of minimum 30 cm height from the finished roof to facilitate maintenance of roof treatment in future. b) For roofs having no structural slope: Screed concrete mix (1:2:4) grading having minimum 25mm thickness at the lowest point of the slope shall be laid over R.C.C. slab and shall be laid as per the slope specified elsewhere in the specification. Top surface of grading underbed shall be finished with 15mm thick cement plaster (1:4). Roof shall be provided with roof water proofing treatment using high solid content liquid applied elastomeric water proofing membrane laid over reinforcing layer of polyscrim cloth or non woven geo-textile, with separate wearing course as per ASTM - C-836 & 898. Thickness of the membrane shall be 1.5mm (min.). This treatment shall include application of polymerised mastic over the roof to achieve smooth surface and primer coat. Wearing course on the top of membrane shall consist of 25mm thick PCC (1:2:4) cast in panels of maximum 1.2 x 1.2m size and reinforced with 0.56mm dia galvanised chicken wire mesh and sealing of joints using sealing compound/elastomeric water proofing membrane. Chequered concrete

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						tile flooring 22 mm (min.) thick of approved colour and shade conforming to IS: 13801 shall be provided for path way of 1 m. width for access of personnel and handling of equipment and for the entire area of the roof where equipment like AC / Ventilation plant, cooling towers, etc. are provided in place of PCC wearing course. Equipment shall be installed on raised pedestal of minimum 30 cm height from the finished roof to facilitate maintenance of roof treatment in future.

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141.	VI/ PA RT- B	D-01	78 OF 142	9.08.0 1	a) Wall Cladding & Roofing Material Troughed permanently colour coated sheet of approved shade and colour shall be i) either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii) or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. iii) or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 	a) Wall Cladding & Roofing Material Troughed permanently colour coated sheet of approved shade and colour shall be i) either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS250 as per IS 15961 / grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii) or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS350 as per IS 15961 / grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. iii) or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS550 as per IS 15961 / grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 /

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						aluminium-zinc alloy coating to class AZ150

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142.	VI/ PA RT- B	D-01	79 OF 142	9.08.0 3	Design Criteria For wall cladding insulated / uninsulated and conveyor gallery sides and roof, permanently colour coated sheet of troughed profile shall be used. However alternative profile meeting the strength, deflection and other functional requirements such as section modulus and moment of inertia shall be provided. Sheet shall be of approved profile, sectional properties, colour and shade. For profiled metal decking sheets (to be used for RCC floor slab or roof slab) the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 under total super imposed loading (DL +LL) comprising the self-weight of metal deck sheet, dead weight of green concrete and an additional construction load 100kg per sq.m for two span condition. The section modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. For metal deck sheets used for roofing (with or without RCC) and side cladding, the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 under design wind pressure for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements.	Design Criteria For wall cladding insulated / uninsulated and conveyor gallery sides and roof, permanently colour coated sheet of troughed profile shall be used. However alternative profile meeting the strength, deflection and other functional requirements such as section modulus and moment of inertia shall be provided. Sheet shall be of approved profile, sectional properties, colour and shade. For profiled metal decking sheets (to be used for RCC floor slab or roof slab) the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 under total super imposed loading (DL +LL) comprising the self-weight of metal deck sheet, dead weight of green concrete and an additional construction load 100kg per sq.m for two span condition. The section modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. For profiled metal sheets used for roofing (without RCC) and side cladding, , the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 under design wind pressure for two span condition. The sectional modulus and

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					No increase in allowable stress is permissible under wind load condition.	moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. No increase in allowable stress is permissible under wind load condition.
143.	VI/ PA RT- B	D-01	82 OF 142	9.10.1 0	All internal paints shall be of low VOC content conforming to GRIHA rating for reduction of VOC content.	All internal paints shall be of low VOC with VOC content less than 50g/litre.
144.	VI/ PA RT- B	D-01	85 OF 142	9.11.1 1	Electrically operated, self operable/closing, aluminium framed with tinted glass, sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building.	Electrically operated, self operable/closing, G.I framed with tinted glass, sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building.
145.	VI/ PA RT- B	D-01	85 OF 142	9.12.0 5	For main power house building glazings, 6mm thk clear reflective toughened glass shall be provided. The glass to be used should be from the manufacturers of glass like Saint Gobain (India) or Asahi (India) or equivalent. The glass should be free from distortion and thermal stress. Solar factor 25% or less, Maximum U-value 3.3 W/ SQMK, VLT min 30%: Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28)	For main power house building glazings, 6mm thick reflective toughened glass shall be provided. The glass to be used should be from the manufacturers of glass like Saint Gobain (India) or Asahi (India) or equivalent. The glass should be free from distortion and thermal stress. Solar factor 25% or less, Maximum U-value 3.3 W/ SQMK, VLT min 30%: Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28)

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146.	VI/ PA RT- B	D-01	85, 86 OF 142	9.12.0 6	For glazings of Air Conditioned..... shall be min 11mm thick clear, toughened, interlayered 120 minute fire rated for both integrity & radiation control (EW120) with min 15 minute full insulation (EI15) , non wired toughened glass complying to BS476 Part22 or (EN-1634-1 :1999). The glass shall be complied to Class 2B2 Category of Impact Resistance to as per EN 12600 safety Glazing Material. The Glass shall have a light transmission ratio of approx. 86% according to EN410.....	For glazings of Air Conditioned..... shall be min 11mm thick clear, toughened, interlayered 120 minute fire rated for both integrity & radiation control (EW120) and confirming to EI15, non wired toughened glass complying to BS476 Part22 or (EN-1634- 1 :1999). The glass shall be complied to Class 2B2 Category of Impact Resistance to as per EN 12600 safety Glazing Material. The Glass shall have a light transmission ratio of approx. 86% according to EN410.....
147.	VI/ PA RT- B	D-01	89,90 of 142	9.16.0 0	Table A: PROPOSED ACID /ALKALI RESISTANT TREATMENT	Deleted
148.	VI/ PA RT- B	D-01	94 of 142	9.16.0 0	TABLE - B v) Passages and general circulation areas. 18mm thick polished Marble Stone/ granite stone.	TABLE - B v) Passages and general circulation, areas around the Lift and stairs lobby. 18mm thick polished Marble Stone/ granite stone.
149.	VI/ PA RT- B	D-01	96 of 142	9.16.0 0	TABLE - B Note : 1. All wall and roof areas above false ceiling shall be plastered.	TABLE - B Note : 1. All walls above false ceiling shall be plastered.

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150.	VI/ PA RT- B	D-01	100 of 142	10.01. 00	The grade of cement shall be Grade 43 for OPC conforming to IS: 8112 .	The grade of cement shall be Grade 43 for OPC conforming to IS: 269 .
151.	VI/ PA RT- B	D-01	100 of 142	10.01. 00	c) RCC for Chimney shell. d) NDCT shell and racker columns of NDCT.	Deleted
152.	VI/ PA RT- B	D-01	100 of 142	10.02. 00 (b)	Fine Aggregate Fine aggregate shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Fine aggregate in concrete shall conform to IS: 383. For plaster, it shall conform to IS: 1542 and for masonry work to IS: 2116.	Fine Aggregate Fine aggregate shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Fine aggregate in concrete shall conform to IS: 383. For plaster, it shall conform to IS: 1542 and for masonry work to IS: 2116. However use of aggregate derived from Construction and Demolition waste or Recycled Concrete Aggregate shall not be permitted.
153.	VI/ PA RT- B	D-01	101 of 142	10.04. 01 c)	c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240.	c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240 and minimum thickness shall be 4 mm.

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154.	VI/ PA RT- B	D-01	135 OF 142	Annex ure-D	CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See Annexure – B for site specific information. Along wind forces shall...	CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See Appendix – I for site specific information. Along wind forces shall...
155.	VI/ PA RT- B	D-01		Annex ure-F		Annexure-F: Area Drainage Study Report
156.	VI/ PA RT- B	D-01		Annex ure-G		Annexure-G: Electrical Resistivity Test Results
157.	VI/ PA RT- D	-	19 OF 52	36.05. 00 c)	The plant site is fully secured against unauthorized access. For the same he shall take up boundary wall construction immediately after award. He may also consider providing temporary fence in full or part as per site requirement.	DELETED

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158.	VI/ PA RT- D	-	13 OF 58	27.03. 00	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.	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 and permitted by Statutory Authority. Any statutory clearance required shall be obtained by the contractor.

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159.	VI/ PA RT- D	-	21,22 OF 58	36.05. 00 b)	Proper drainage of rain water, ground water from excavations, water flows from batching plant / construction sites etc. He shall prioritise the construction of permanent drains from the start of the project itself. Till such time the permanent drainage network is done, he shall construct adequate temporary drains to ensure that there is no accumulation /stagnation of water in the plant site. Bidder may consider providing pre-cast RCC drains for temporary/ permanent drain construction for faster construction of drains. The drain construction shall be matched with progress of road construction for preventing damage to roads. Bidder shall provide and maintain adequate number of drainage pumps (both electrical and diesel operated) of suitable capacity for pumping out accumulated water especially during the monsoon periods. All drain diversions required shall be undertaken at the start of the project itself.	Proper drainage of rain water, ground water from excavations, water flows from batching plant / construction sites etc. He shall prioritise the construction of permanent drains from the start of the project itself. Till such time the permanent drainage network is done, he shall construct adequate temporary drains to ensure that there is no accumulation /stagnation of water in the plant site. Bidder may consider providing pre-cast RCC drains for temporary/ permanent drain construction for faster construction of drains. The drain construction shall be matched with progress of road construction for preventing damage to roads. Bidder shall provide and maintain adequate number of drainage pumps (both electrical and diesel operated) of suitable capacity for pumping out accumulated water especially during the monsoon periods. <i>Silt traps shall be provided to arrest sediments before reaching the receiving water bodies.</i>

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160.	VI/ PA RT- D	-	22 OF 58	36.05. 00 d)	Proper housekeeping by systematic and proper disposal of earth from excavations (separately for usable & surplus earth), muck (from pile bores or otherwise), wastes (from dismantling of pile tops, concrete works etc), packing & insulation wastes, steel scrap, cable wastes etc generated during construction / erection works. Suitable disposal sites for each of above shall be identified in the layout and at site in the beginning of the project itself. It shall be ensured that all agencies engaged by the bidder follow the discipline to dispose off of earth spoils and wastes at the designated places. Preferably once in a week suitable time slot will be identified for housekeeping by all agencies and suitable instructions shall be issued in this regard. Bidder may engage a separate agency or identify a gang for collection of wastes and disposal to designated places. Suitable arrangement / tieup will also be made for periodic disposal of wastes/ scrap from the designated places.	<i>Tyres of vehicles/dumpers entering the existing public roads/highways from construction site/borrow area shall be clear of dirt/earth. To ensure this, suitable arrangement for washing/cleaning of tyres of vehicles/dumpers shall be made at entry points to public roads/highways from plant site and borrow areas.</i> Proper housekeeping by systematic and proper disposal of earth from excavations (separately for usable & surplus earth), muck (from pile bores or otherwise), wastes (from dismantling of pile tops, concrete works etc), packing & insulation wastes, steel scrap, cable wastes etc generated during construction / erection works. Suitable disposal sites for each of above shall be identified in the layout and at site in the beginning of the project itself. It shall be ensured that all agencies engaged by the bidder follow the discipline to dispose off of earth spoils and wastes at the designated places. Preferably once in a week suitable time slot will be identified for housekeeping by all agencies and suitable instructions shall be issued in this regard. Bidder may engage a separate agency or identify a gang for collection of wastes and disposal to designated places. Suitable arrangement / tieup will also be made for periodic disposal of wastes/ scrap from the designated places.

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161.	VI/ PA RT- D	-	22 OF 52	36.05. 00 e)	All fabrication areas shall be suitably hard crusted to provide a water free and proper working platforms. Suitable sheds preferably pre engineered structures to be provided for paint shops, fabrication workshops etc for ensuring all weather work conditions for onsite structural works. <i>For the main plant and auxiliary buildings, bidder should preferably plan the works in such a way that structural fabrication is done in suppliers' offsite works / workshops and onsite fabrication works are avoided / kept minimum.</i>	<i>For most of the structures/buildings made up of structural steel, fabrication is to be carried out in the factory itself. Only erection with bolted connection is envisaged at the site. For certain structures/buildings/utilities for which site fabrication is allowed, the fabrication areas shall be suitably hard crusted to provide a water free and proper working platforms. Suitable sheds preferably pre engineered structures to be provided for paint shops, fabrication workshops etc for ensuring all weather work conditions for onsite structural works.</i>

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162.	VI/ PA RT- D	-	23 OF 52	36.05. 00 m)	Compliance to all environment and other conditions stipulated by the concerned statutory authorities while according clearance / NOC to the project. Bidder shall ensure adequate sprinkling of water by deploying water tankers to prevent the fugitive dust nuisance during construction.	m) Compliance to all environment and other conditions stipulated by the concerned statutory authorities while according clearance / NOC to the project. Bidder shall ensure adequate sprinkling of water by deploying water tankers to prevent the fugitive dust nuisance during construction. <i>Borrow Earth being transported in vehicles by road shall be suitably covered to avoid spillage onto the roads. Movement of all vehicles transporting earth shall be controlled so as not to cause disruption to regular users of the roads. Traffic marshals shall be deployed by bidder to regulate traffic on National highway/public roads. Cleaning of National highway/public roads shall be done on daily basis by the bidder. Bidder shall take necessary permission from NHAI and Local Authorities for use of National Highway/Other public roads for transporting borrow earth from areas identified in tender drawings and/or from other areas outside plant boundary. Bidder shall refer clause 36.05.00 (d) above in this regard.</i>

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163.	VI/ PA RT- D	-	23 OF 58	36.05. 00 n)	Development of suitable landscape & green belt areas and rainwater harvesting within the plant premises. Bidder shall plan to develop the landscape & green belt areas and rainwater harvesting from the start of the project itself. The landscape and rainwater harvesting plan shall be finalized immediately after award of work and suitable work plan with priority and schedule shall also be finalized thereafter. Top soil before excavation shall be suitably preserved and stacked for landscape and green belt development.	Development of suitable landscape and rainwater harvesting within the plant premises. Bidder shall plan to develop the landscape and rainwater harvesting from the start of the project itself. The landscape and rainwater harvesting plan shall be finalized immediately after award of work and suitable work plan with priority and schedule shall also be finalized thereafter. Top soil before excavation shall be suitably preserved and stacked for landscape and green belt development.
164.	VI/ PA RT- E (Te nder Dra win gs)				Drawing no. 9915-999-POC-F-001 (REV. 0) titled "GENERAL LAYOUT PLAN"	Drawing no. 9915-999-POC-F-001 (REV. 1) titled "GENERAL LAYOUT PLAN"
165.	VI/ PA RT- E					Drawing Nos. 9915-371-POC-A-001 titled "Site Levelling Plan", 9915-371-POC-A-002 titled "Layout of Roads" and 9915-371-POC-A-003 titled "Layout of Drains" added for information purpose only

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166.	VI/ PART-A	FORMATS FOR FILLING DETAILS OF PROVENNESS	99 of 106	SUB: Provenness Criteria for Civil Works (I) We declare As indicated below.		SUB: Provenness Criteria for Civil Works (I) We declare As indicated below.			
				Ref of QR	Clause 8.1	Ref of QR	Clause 8.1	Clause 8.2	Clause 8.3
				Whether Bidder meets the requirement	*Yes/No	Whether Bidder meets the requirement	*Yes/No	*Yes/No	*Yes/No
				** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	*Yes/No	*Yes/No
				** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	*Yes/No	*Yes/No
				** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	*Yes/No	*Yes/No
						** Whether Sub-vendor/Civil Construction Agency M/s..... meets part of the requirement	*Yes/No	*Yes/No	*Yes/No

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-04

PAGE 86 OF 91

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

						ion Agency M/s..... meets part of the requirem ent				
						** Whether Sub- vendor/Ci vil Construct ion Agency M/s..... meets part of the requirem ent	*Yes/No	*Yes/N o	*Yes/No	

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-04

PAGE 87 OF 91

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

167.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	100 of 106		(II) We declare that we/our Sub-vendor's/ Agency(ies) meet the Criteria stipulated at Clause No. 8.5 of Part-A, Sub-Section A-1 of Section-VI of our own*/jointly with our Sub-Vendors as indicated below: S. No. Ref. of QR Clause 8.5 	(II) We declare that we/our Sub-vendor's/ Agency(ies) meet the Criteria stipulated at Clause No. 8.6 of Part-A, Sub-Section A-1 of Section-VI of our own*/jointly with our Sub-Vendors as indicated below: S. No. Ref. of QR Clause 8.6
168.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	101 of 106		(III) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1/8.3 of Sub-Section A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed Piling works for a Coal based/Lignite based power plant of 500MW or higher capacity, as per details given below: 	(III) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.3 of Sub-Section A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed Piling works (minimum 600mm diameter), as per details given below:

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

169.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	101, 102 of 106	(IV) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1/8.3 of Sub-Section-A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed structural steel fabrication & erection works related to Main Power House Building for a Coal based/Lignite based power plant of 500MW or higher capacity , as per details given below:	(IV) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1/8.2(b) of Sub-Section A=1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed structural steel fabrication & erection works related to TG building/Bunker building of 500 MW or higher capacity (coal based/Lignite based) power plant / TG Building of Nuclear Power Plant / Steel Melting Shop/Proportioning Bin Building of Steel Plant , as per details given below:
170.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	102, 103 of 106	(V) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1/8.3 of Sub-Section A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed RCC works related to Main Power House Building for a Coal based/Lignite based plant of 500MW or higher capacity , as per details given below:	(V) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1/8.2(a) of Sub-Section A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed RCC works related to TG building/Bunker building of 500 MW or higher capacity coal based/Lignite based power plant/ TG Building of Nuclear Power Plant , as per details given below:

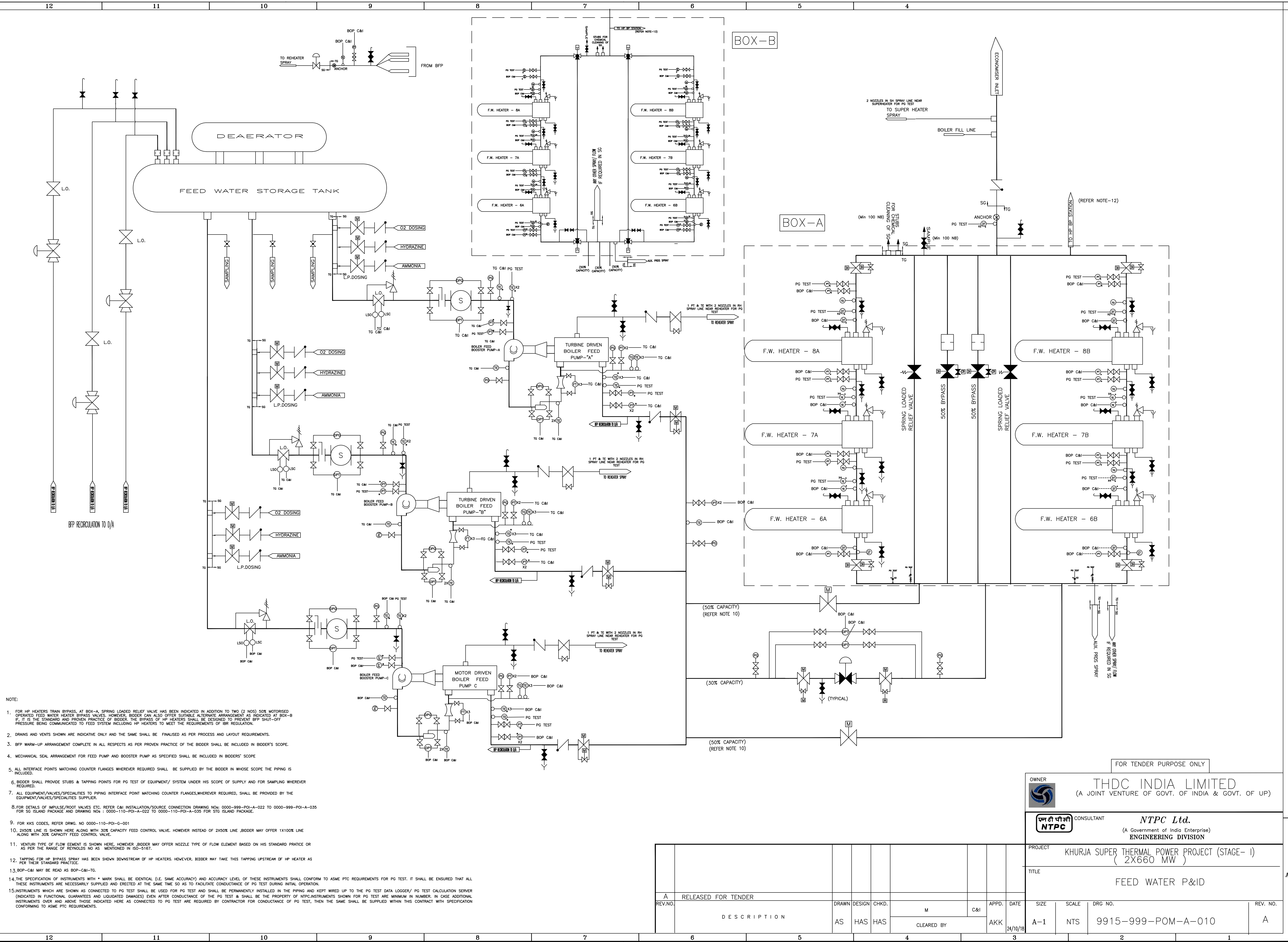
AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

171.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	103, 104 of 106		(VI) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1/8.3 of Sub-Section A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed RCC works related to Turbo Generator Foundation for a thermal power plant of 500MW or higher capacity, as per details given below:	(VI) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.1 of Sub-Section A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have executed RCC works related to Turbo Generator Foundation for a thermal power plant of 500MW or higher capacity, as per details given below:
172.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	104, 105 of 106		(VII) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.5 of Sub-Section-A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have carried out the design and detail engineering of Main Plant Building , for a coal based/lignite based power plant of 500MW or higher capacity as per details given below :	(VII) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.6 of Sub-Section-A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have carried out the design and detail engineering of Main Plant Building , for a coal based/lignite based power plant of 500MW or higher capacity as per details given below :

AMENDMENT NO. 04 TO BIDDING DOCUMENTS (TECHNICAL SPECIFICATION)

173.	VI/ PA RT- A	FORMA TS FOR FILLING DETAIL S OF PROVE NNESS	106 of 106		(VIII) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.5 of Sub-Section-A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have carried out the design and detail engineering of Turbo Generator Foundation (with or without Vibration Isolation System as offered by bidder) , for a coal based/lignite based power plant of 500MW or higher capacity as per details given below : 	(VIII) In order to satisfy the Qualifying Requirements stipulated at Clause No. 8.6 of Sub-Section-A-1, Part-A of section-VI, we declare that *We/our Sub-Vendors *M/s. have carried out the design and detail engineering of Turbo Generator Foundation (with or without Vibration Isolation System as offered by bidder) , for a coal based/lignite based power plant of 500MW or higher capacity as per details given below :

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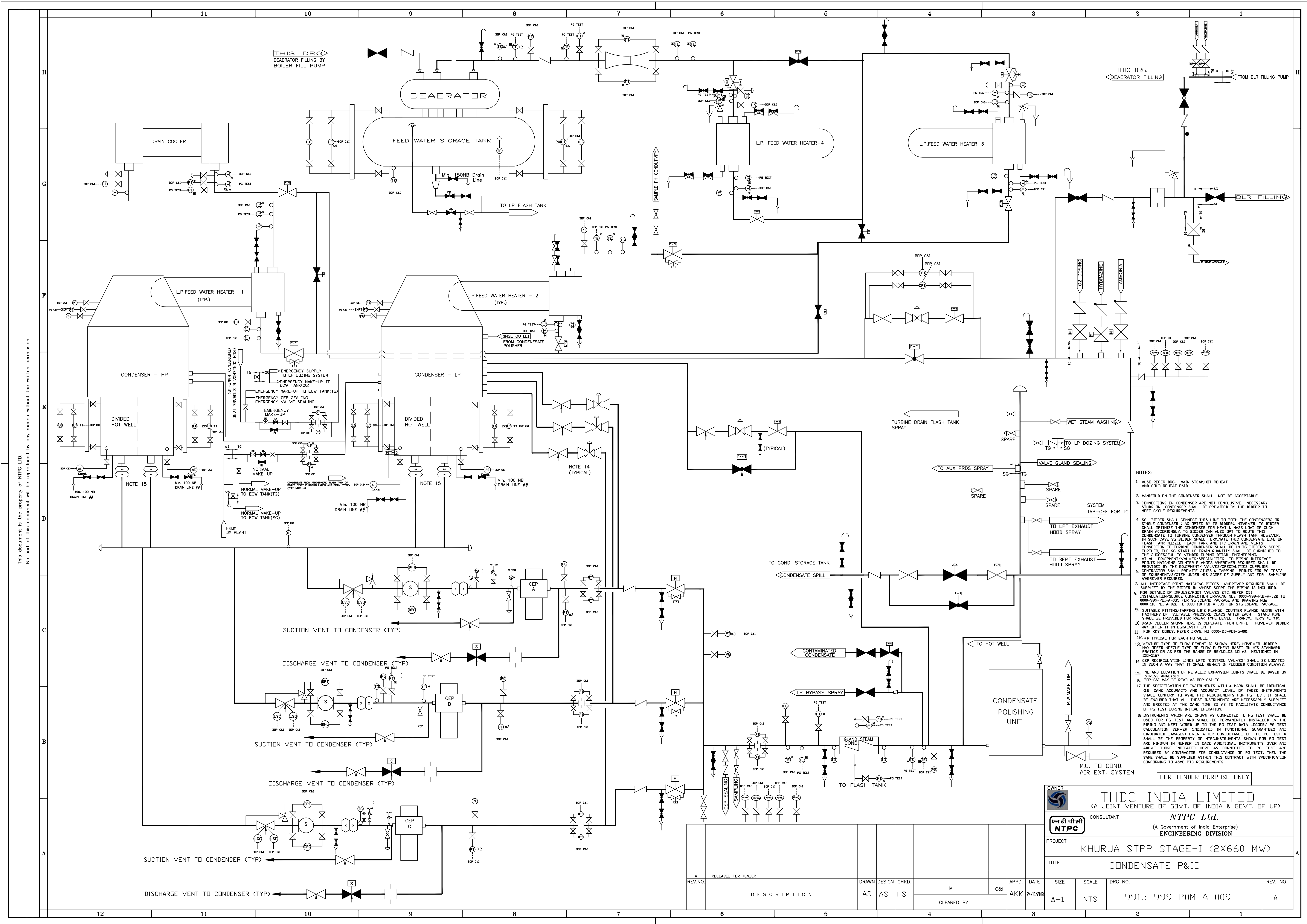


- NOTE:
- FOR HP HEATERS TRAP BYPASS, AT BOX-A SPRING LOADED RELIEF VALVE HAS BEEN INDICATED IN ADDITION TO TWO (2 NOS) 50% MOTORISED OPERATED FEED WATER HEATER BYPASS VALVES. HOWEVER, BIDDER CAN ALSO OFFER SUITABLE ALTERNATE ARRANGEMENT AS INDICATED AT BOX-B IF IT IS THE STANDARD AND PROVEN PRACTICE OF BIDDER. THE BYPASS OF HP HEATERS SHALL BE DESIGNED TO PREVENT BFP SHUT-OFF PRESSURE BEING COMMUNICATED TO FEED SYSTEM INCLUDING HP HEATERS TO MEET THE REQUIREMENTS OF IFR REGULATION.
 - DRAINS AND VENTS SHOWN ARE INDICATIVE ONLY AND THE SAME SHALL BE FINALISED AS PER PROCESS AND LAYOUT REQUIREMENTS.
 - BFP WARM-UP ARRANGEMENT COMPLETE IN ALL RESPECTS AS PER PROVEN PRACTICE OF THE BIDDER SHALL BE INCLUDED IN BIDDER'S SCOPE.
 - MECHANICAL SEAL ARRANGEMENT FOR FEED PUMP AND BOOSTER PUMP AS SPECIFIED SHALL BE INCLUDED IN BIDDER'S SCOPE.
 - ALL INTERFACE POINTS MATCHING COUNTER FLANGES WHEREVER REQUIRED SHALL BE SUPPLIED BY THE BIDDER IN WHOSE SCOPE THE PIPING IS INCLUDED.
 - BIDDER SHALL PROVIDE STUBS & TAPPING POINTS FOR PG TEST OF EQUIPMENT/ SYSTEM UNDER HIS SCOPE OF SUPPLY AND FOR SAMPLING WHEREVER REQUIRED.
 - ALL EQUIPMENT/VALVES/SPECIALITIES TO PIPING INTERFACE POINT MATCHING COUNTER FLANGES, WHEREVER REQUIRED, SHALL BE PROVIDED BY THE EQUIPMENT/VALVES/SPECIALITIES SUPPLIER.
 - 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.
 - FOR KKS CODES, REFER DRWG. NO 0000-110-POI-G-001.
 - 2X50% LINE IS SHOWN HERE ALONG WITH 30% CAPACITY FEED CONTROL VALVE. HOWEVER INSTEAD OF 2X50% LINE, BIDDER MAY OFFER 1X100% LINE ALONG WITH 30% CAPACITY FEED CONTROL VALVE.
 - 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.
 - TAPPING FOR HP BYPASS SPRAY HAS BEEN SHOWN DOWNSTREAM OF HP HEATERS. HOWEVER, BIDDER MAY TAKE THIS TAPPING UPSTREAM OF HP HEATER AS PER THEIR STANDARD PRACTICE.
 - 3, BOP-C&I MAY BE READ AS BOP-C&I-TG.
 - 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 ERRECTED AT THE SAME TIME SO AS TO FACILITATE CONDUCTANCE OF PG TEST DURING INITIAL OPERATION.
 - 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.

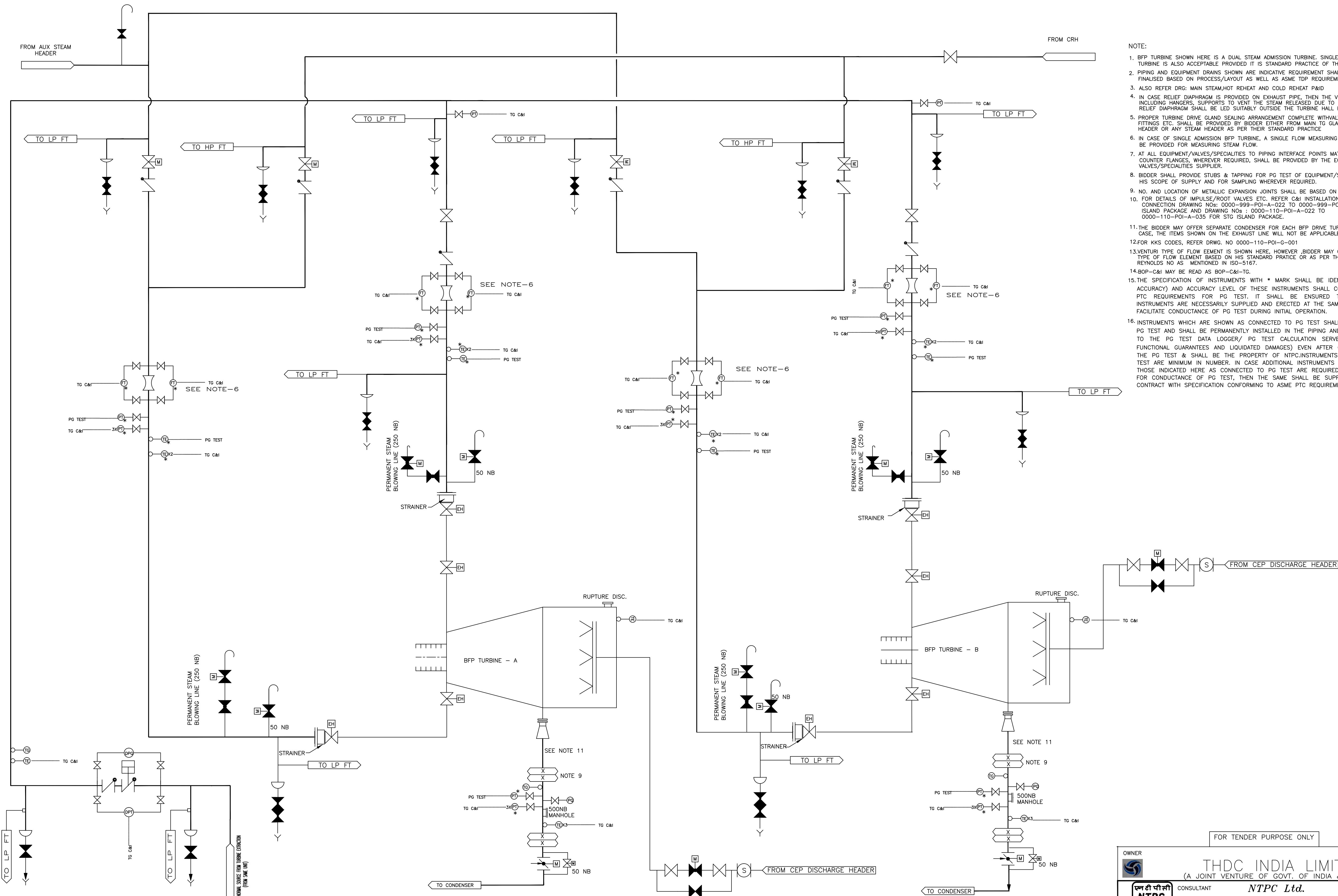
A		RELEASED FOR TENDER		DRAWN DESIGN CHKD.		M C&I		APPD. DATE		SIZE SCALE DRG NO.		REV. NO.	
A		DESCRIPTION		AS HAS HAS		CLEARED BY		AKK		24/10/18		A	
A		PROJECT		KHURJA SUPER THERMAL POWER PROJECT (STAGE- I)		TITLE		FEED WATER P&ID		9915-999-POM-A-010		REV. NO.	
A		OWNER		THDC INDIA LIMITED		CONSULTANT		NTPC Ltd.		(A Government of India Enterprise)		ENGINEERING DIVISION	
A		FOR TENDER PURPOSE ONLY		OWNER		CONSULTANT		NTPC Ltd.		(A Government of India Enterprise)		ENGINEERING DIVISION	

- ## NOTES
1. ALL DRAINS SHALL BE LED TO THE ATMOSPHERIC FLASH TANK SHOWN IN DRG: STEAM DRAIN SYSTEM P&ID.
 2. DRAINS AND VENTS SHOWN IN THIS DRAWING ARE INDICATIVE ONLY. FINAL REQUIREMENT SHALL BE FINALISED BASED ON PROCESS & LAYOUT CONSIDERATIONS.
 3. THE BIDDER MAY PROVIDE COMBINED PRESSURE REDUCING CUM DESUPERHEATING VALVE OR PRESSURE REDUCING VALVE WITH A SEPARATE DESUPERHEATER AS SHOWN IN BOX-A.
 4. DESUPERHEATING WATER FOR HPCPDS SPRAY IS SHOWN FROM BFP DISCHARGE/ INTERMEDIATE STAGE. THE SAME CAN BE CHANGED TO ANY OTHER APPROPRIATE LOCATION, INCASE BIDDER OPTS FOR HPCPDS SPRAY FROM CUM DISCHARGE, THE SPRAY STATION SHALL BE REPLACED BY THE ONE SHOWN IN BOX-B
 5. AT ALL EQUIPMENT/VALVES/SPECIALITIES TO PIPING INTERFACE POINT MATCHING COUNTER FLANGES, WHEREVER REQUIRED, SHALL BE SUPPLIED BY THE EQUIPMENT/VALVES/SPECIALITIES SUPPLIER.
 6. BIDDER SHALL PROVIDE STUBS AND TAPPINGS FOR PG TEST OF EQUIPMENTS/SYSTEM UNDER HIS SCOPE OF SUPPLY AND FOR SAMPLING WHEREVER REQUIRED.
 7. NO. OF SAFETY VALVES SHOWN ON PIPINGS IS INDICATIVE ONLY. THIS SHALL BE AS PER SPECIFICATIONS/MANUFACTURERS STANDARD PRACTICE.
 8. 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.

								PROJECT KHURJA SUPER THERMAL POWER PROJECT (STAGE-I) (2X660MW)				
								TITLE AUXILIARY STEAM SYSTEM P&ID				
A	RELEASED FOR TENDER											
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	C&I	APPD.	DATE	SIZE	SCALE	DRG NO.	REV. NO.
		AS	HAS	HAS	CLEARED BY		AKK	24/10/18	A-1	NTS	9915-999-POM-A-006	A



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- NOTE:
1. BFP TURBINE SHOWN HERE IS A DUAL STEAM ADMISSION TURBINE. SINGLE ADMISSION TURBINE IS ALSO ACCEPTABLE PROVIDED IT IS STANDARD PRACTICE OF THE MANUFACTURER.
 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 LED 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 TG 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

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	C&I	APPD.	DATE
A	RELEASED FOR TENDER	AS	HAS	HAS			AKK	24/10/18
Cleared by								

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



10. THE SPECIFICATION OF INSTRUMENTS WITH * MARK SHALL BE IDENTICAL (I.E. SAME ACCURACY) AND ACCURACY LEVEL OF THESE INSTRUMENTS SHALL CONFORM TO ASME PT 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.
11. 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 PROPORTION OF NUMBER OF INSTRUMENTS SHOWN FOR PG TEST ARE MINIMUM IN NUMBER. IN CASE ADDITIONAL INSTRUMENTS OVER AND ABOVE MENTIONED 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 PT REQUIREMENTS.

FOR TENDER PURPOSE ONLY

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

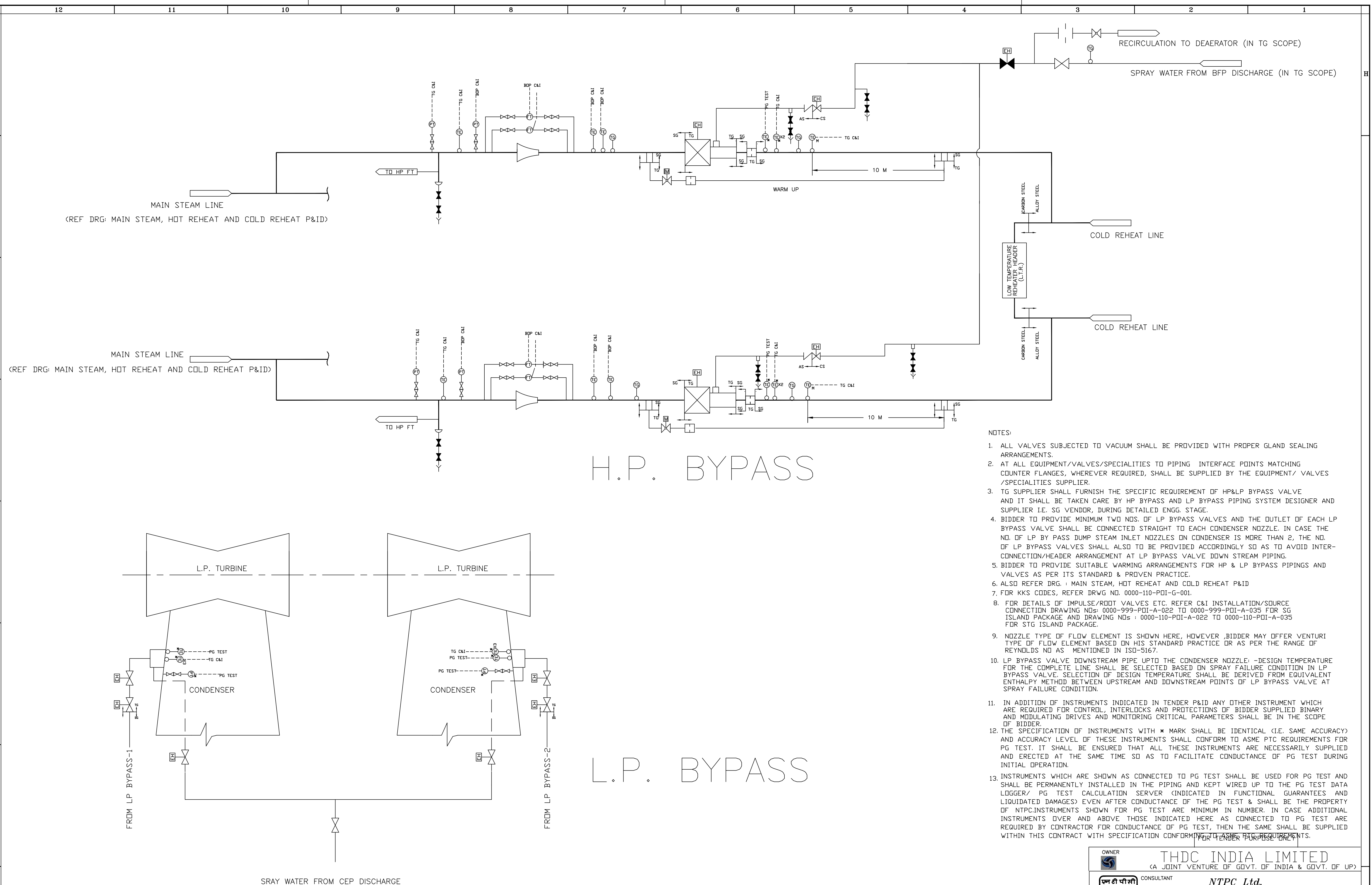
CONSULTANT

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

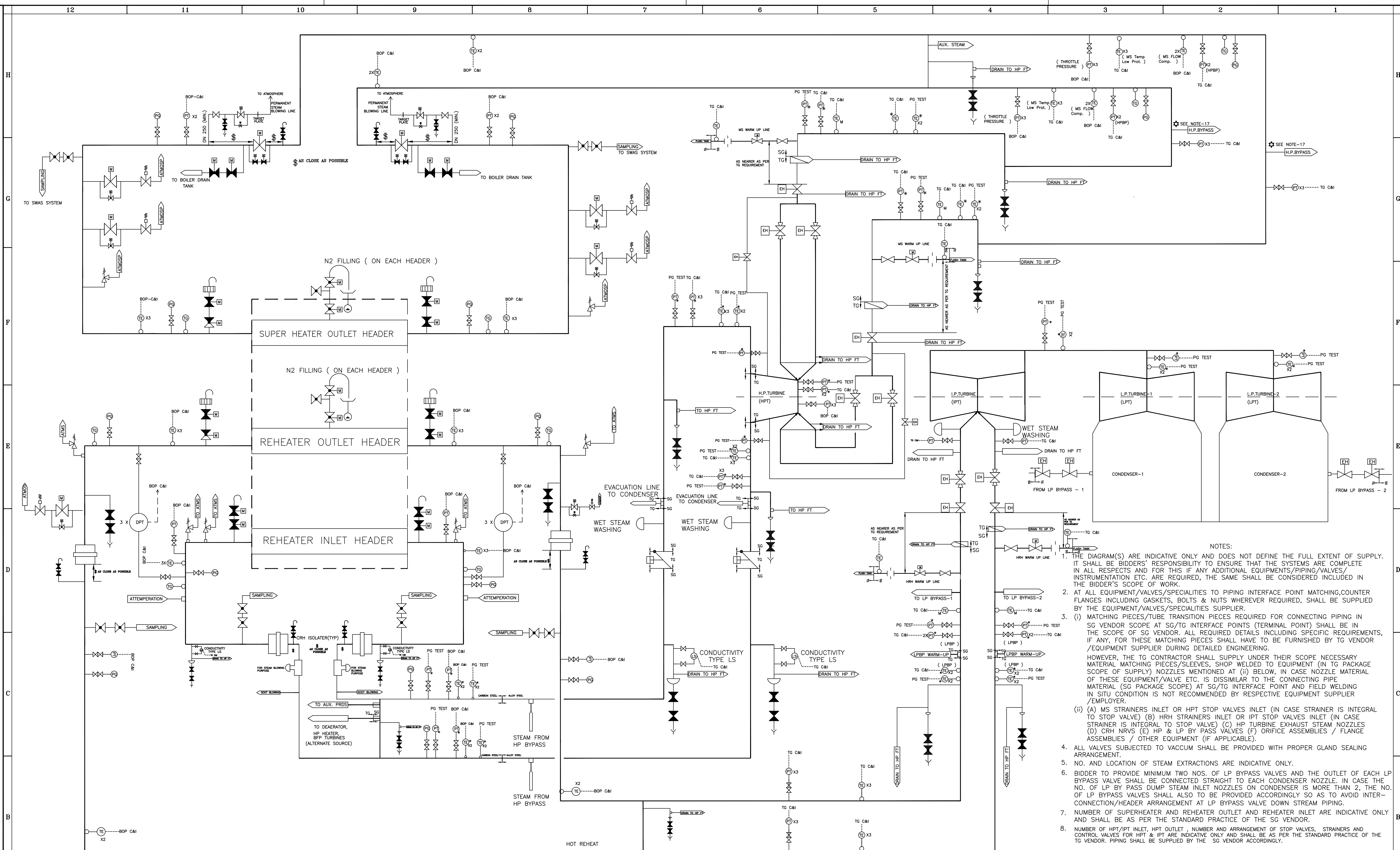
PROJECT	KHURJA SUPER THERMAL POWER PROJECT (STAGE-I) (2X660 MW)

TITLE	EXTRACTION STEAM P&ID FOR HEATERS

SIZE A-1	SCALE NTS	DRG NO. 9915-999-POM-A-007	REV. NO. A



										 A Government of India Enterprise ENGINEERING DIVISION PROJECT KHURJA SUPER THERMAL POWER PROJECT (STAGE- I) (2X660 MW)									
										A TITLE HP & LP BYPASS SYSTEM P&ID									
A RELEASED FOR TENDER AS HAS HAS										AKK 24/10/18									
REV.NO. DESCRIPTION DRAWN DESIGN CHKD.										M C&I CLEARED BY APPD. DATE SIZE A-1 SCALE NTS DRG NO. 9915-999-PDM-A-005 REV. NO. A									



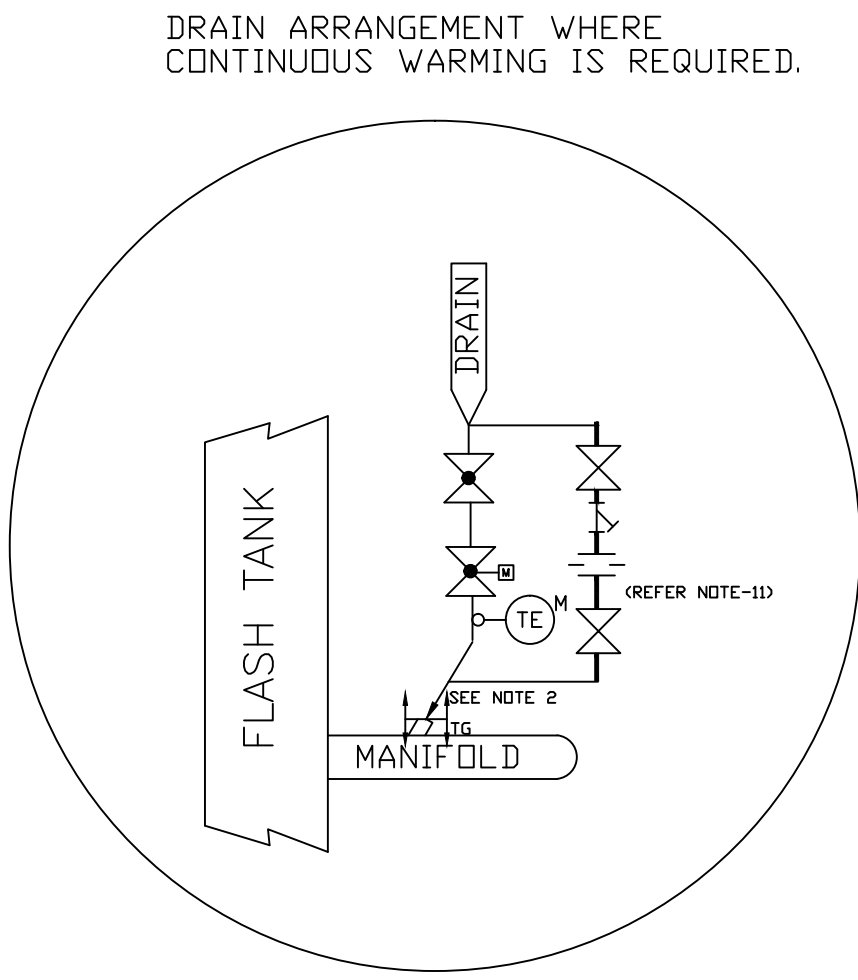
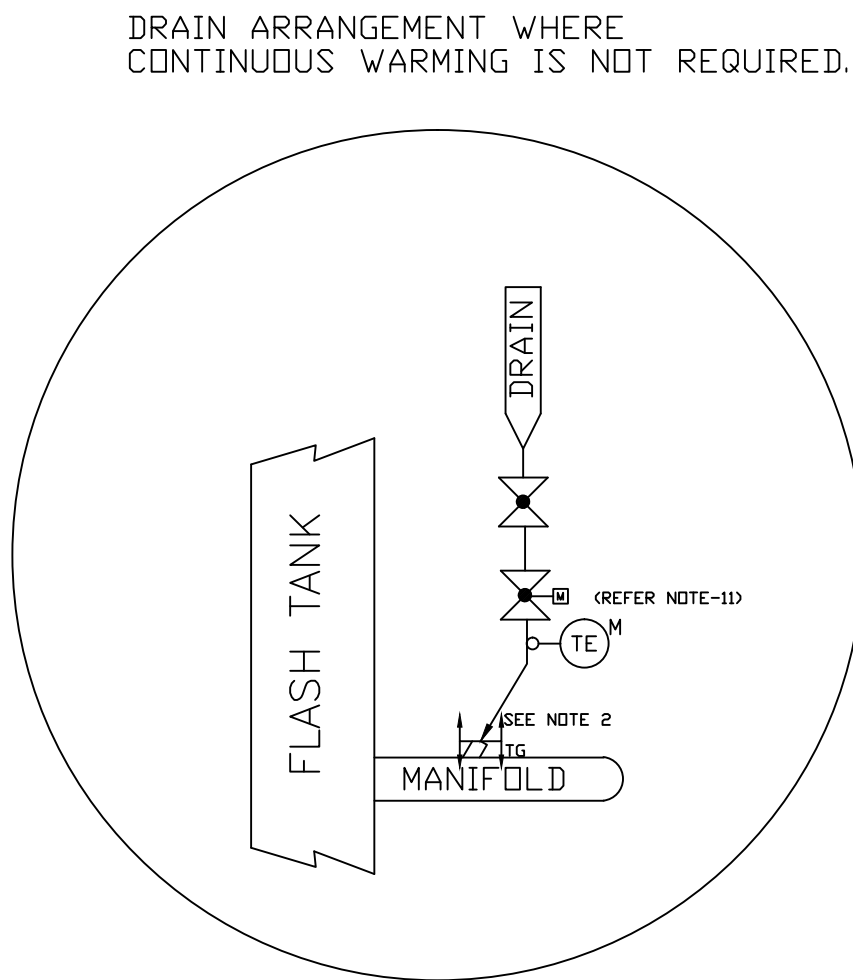
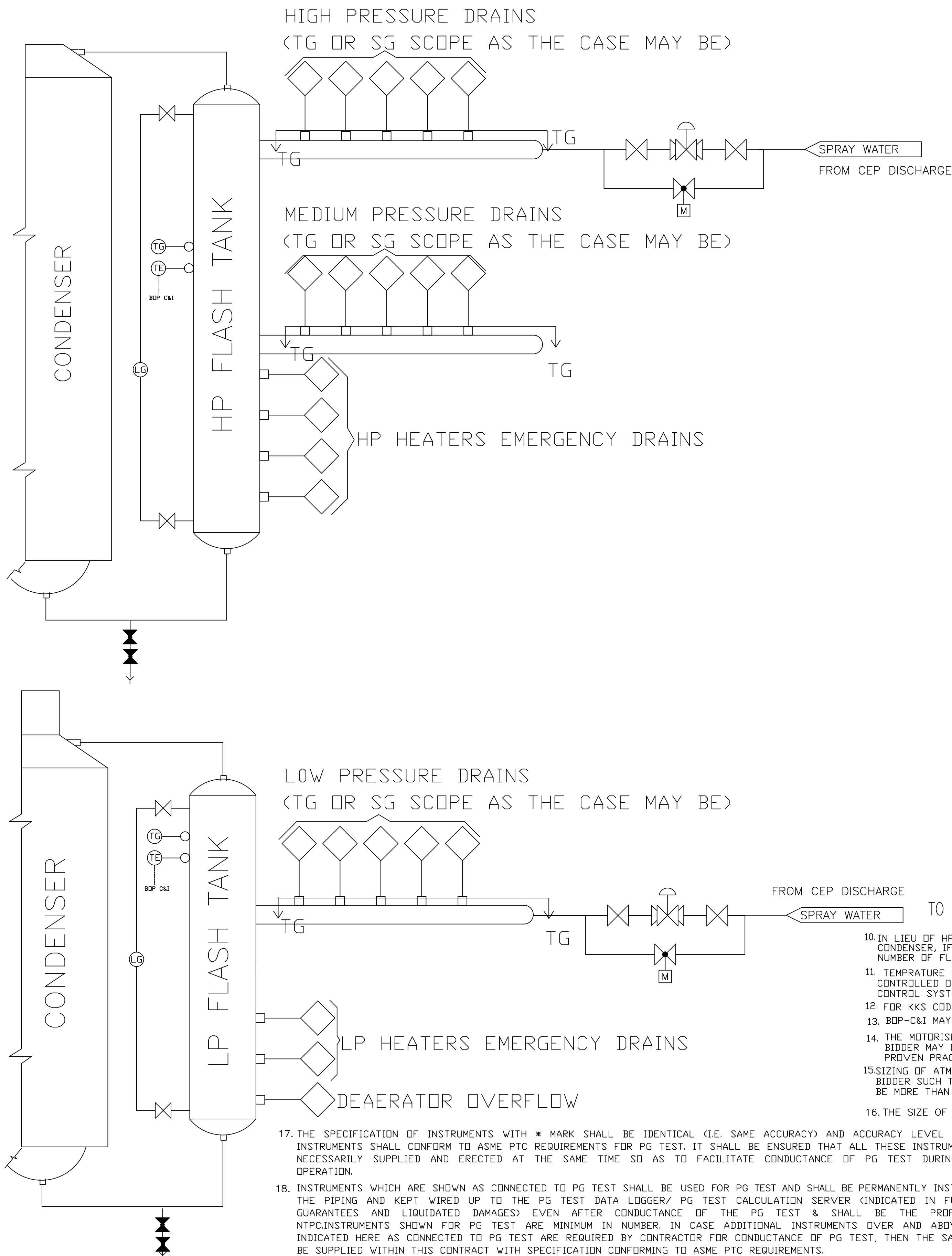
9. REFER NOTE 7 & 8. THE QUANTITY OF INSTRUMENTS OF THE ABOVE PIPING SHALL BE SUPPLIED BY THE RESPECTIVE VENDOR ACCORDINGLY.
10. NUMBER OF SAFETY VALVES SHOWN ON PIPING IS INDICATIVE ONLY. THIS SHALL BE AS PER SPECIFICATION/MANUFACTURER'S STANDARD PRACTICE.
11. PIPING AND EQUIPMENT DRAINS SHOWN ARE INDICATIVE ONLY. REQUIREMENT SHALL BE FINALISED BASED ON PROCESS/LAYOUT CONSIDERATIONS AS WELL AS ASME TDP REQUIREMENTS.
12. ALL EQUIPMENTS AND PIPING SHALL BE PROVIDED WITH PROPER DRAINAGE AND VENTING ARRANGEMENT. THE DRAIN SHALL BE LED TO THE NEAREST AVAILABLE PLANT DRAIN. INADDITION TO WHATEVER IS SHOWN IN THE DRAWING, ALL THE REQUIREMENTS OF ASME-TDP-1 (LATEST) SHALL BE MET.
13. FOR PG TEST OF EQUIPMENT/ SYSTEM AND SAMPLING, STUBS AND TAPPINGS REQUIRED ON THE PIPING SHALL BE SUPPLIED AND ERECTED BY THE PIPING SUPPLIER, IRRESPECTIVE OF SCOPE OF SUPPLY OF EQUIPMENT FOR WHICH PG TEST INSTRUMENTS ARE REQUIRED TO BE PROVIDED ON PIPINGS. THE DETAIL OF STUBS REQUIRED SHALL BE FURNISHED BY EQUIPMENT SUPPLIER DURING DETAIL ENGINEERING.
14. 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.
15. IN CASE STEAM TURBINES ARE HAVING STEAM INLET NOZZLES ON ITS TOP HALF PORTION, FLANGE JOINTS SHALL BE PROVIDED ON EACH PIPING CONNECTED TO THESE NOZZLES TO FACILITATE REMOVAL OF TURBINE TOP CASING DURING MAINTENANCE WITHOUT CUTTING THE PIPES. ACCORDINGLY, IN THE ABOVE CASE, THESE FLANGES (COMPLETE FLANGE ASSEMBLY) SHALL BE SUPPLIED BY TG CONTRACTOR AND SHALL BE ERECTED BY SG CONTRACTOR.
16. FOR KKS CODES, REFER DRWG NO. 0000-110-POI-G-001,R-0.
17. BIDDER MAY ALSO OFFER TAP-OFF FOR HP BYPASS FROM MS EQUALISING LINE IN PLACE OF INDEPENDENT TAP-OFFS FROM BOTH MAIN STEAM LEADS AS SHOWN.
18. IN PLACE OF DOUBLE LEADS FOR COLD REHEAT, AS SHOWN, THE BIDDER MAY ALSO OFFER SINGLE LEAD AFTER CRH NRV. THE INSTRUMENTATION SHALL BE AS PER THE PHILOSOPHY MENTIONED IN THE TECHNICAL SPECIFICATION.
19. IN ADDITION OF INSTRUMENTS INDICATED IN TENDER P&ID ANY OTHER INSTRUMENT WHICH ARE REQUIRED FOR CONTROL, INTERLOCKS AND PROTECTIONS OF BIDDER SUPPLIED BINARY AND MODULATING DRIVES AND MONITORING CRITICAL PARAMETERS SHALL BE IN THE SCOPE OF BIDDER.
20. MS WARM UP & HRH WARM UP LINE SHALL BE PROVIDED BY SG VENDOR IN EACH LINE/LEAD IF REQUIRED BY TG VENDOR.

21. 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.
22. 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.

- NOTES:
- THE DIAGRAM(S) ARE INDICATIVE ONLY AND DOES NOT DEFINE THE FULL EXTENT OF SUPPLY. IT SHALL BE BIDDERS' RESPONSIBILITY TO ENSURE THAT THE SYSTEMS ARE COMPLETE IN ALL RESPECTS AND FOR THIS IF ANY ADDITIONAL EQUIPMENTS/PIPING/VALVES/ INSTRUMENTATION ETC. ARE REQUIRED, THE SAME SHALL BE CONSIDERED INCLUDED IN THE BIDDER'S SCOPE OF WORK.
 - AT ALL EQUIPMENT/VALVES/SPECIALITIES TO PIPING INTERFACE POINT MATCHING, COUNTER FLANGES INCLUDING GASKETS, BOLTS & NUTS WHEREVER REQUIRED, SHALL BE SUPPLIED BY THE EQUIPMENT/VALVES/SPECIALITIES SUPPLIER.
 - (i) MATCHING PIECES/TUBE TRANSITION PIECES REQUIRED FOR CONNECTING PIPING IN SG VENDOR SCOPE AT SG/TG INTERFACE POINTS (TERMINAL POINT) SHALL BE IN THE SCOPE OF SG VENDOR. ALL REQUIRED DETAILS INCLUDING SPECIFIC REQUIREMENTS, IF ANY, FOR THESE MATCHING PIECES SHALL HAVE TO BE FURNISHED BY TG VENDOR /EQUIPMENT SUPPLIER DURING DETAILED ENGINEERING. HOWEVER, THE TG CONTRACTOR SHALL SUPPLY UNDER THEIR SCOPE NECESSARY MATERIAL MATCHING PIECES/SLEEVES, SHOP WELDED TO EQUIPMENT (IN TG PACKAGE SCOPE OF SUPPLY) NOZZLES MENTIONED AT (ii) BELOW, IN CASE NOZZLE MATERIAL OF THESE EQUIPMENT/VALVE ETC. IS DISSIMILAR TO THE CONNECTING PIPE MATERIAL (SG PACKAGE SCOPE) AT SG/TG INTERFACE POINT AND FIELD WELDING IN SITU CONDITION IS NOT RECOMMENDED BY RESPECTIVE EQUIPMENT SUPPLIER /EMPLOYER.
(ii) (A) MS STRAINERS INLET OR HPT STOP VALVES INLET (IN CASE STRAINER IS INTEGRAL TO STOP VALVE) (B) HRH STRAINERS INLET OR IPT STOP VALVES INLET (IN CASE STRAINER IS INTEGRAL TO STOP VALVE) (C) HP TURBINE EXHAUST STEAM NOZZLES (D) CRH NRVs (E) HP & LP BY PASS VALVES (F) ORIFICE ASSEMBLIES / FLANGE ASSEMBLIES / OTHER EQUIPMENT (IF APPLICABLE)
 - ALL VALVES SUBJECT TO VACUUM SHALL BE PROVIDED WITH PROPER GLAND SEALING ARRANGEMENT.
 - NO. AND LOCATION OF STEAM EXTRACTIONS ARE INDICATIVE ONLY.
 - BIDDER TO PROVIDE MINIMUM TWO NOS. OF LP BYPASS VALVES AND THE OUTLET OF EACH LP BYPASS VALVE SHALL BE CONNECTED STRAIGHT TO EACH CONDENSER NOZZLE. IN CASE THE NO. OF LP BY PASS DUMP STEAM INLET NOZZLES ON CONDENSER IS MORE THAN 2, THE NO. OF LP BYPASS VALVES SHALL ALSO TO BE PROVIDED ACCORDINGLY SO AS TO AVOID INTER-CONNECTION/HEADER ARRANGEMENT AT LP BYPASS VALVE DOWN STREAM PIPING.
 - NUMBER OF SUPERHEATER AND REHEATER OUTLET AND REHEATER INLET ARE INDICATIVE ONLY AND SHALL BE AS PER THE STANDARD PRACTICE OF THE SG VENDOR.
 - NUMBER OF HPT/IPT INLET, HPT OUTLET, NUMBER AND ARRANGEMENT OF STOP VALVES, STRAINERS AND CONTROL VALVES FOR HPT & IPT ARE INDICATIVE ONLY AND SHALL BE AS PER THE STANDARD PRACTICE OF THE TG VENDOR. PIPING SHALL BE SUPPLIED BY THE SG VENDOR ACCORDINGLY.

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		MAIN STEAM, HOT REHEAT & COLD REHEAT P&ID							
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	C&I	APPD.	DATE	REV. NO.
A	RELEASED FOR TENDER	AS	HAS	HAS				AKK 24/10/18	
					CLEARED BY				

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DRAINS OF STEAM LINES
(TG OR SG SCOPE AS THE CASE MAY BE)

AUXILIARY STEAM LINE DRAINS

FEED WATER SAFETY VALVE DISCHARGE

NOTE:

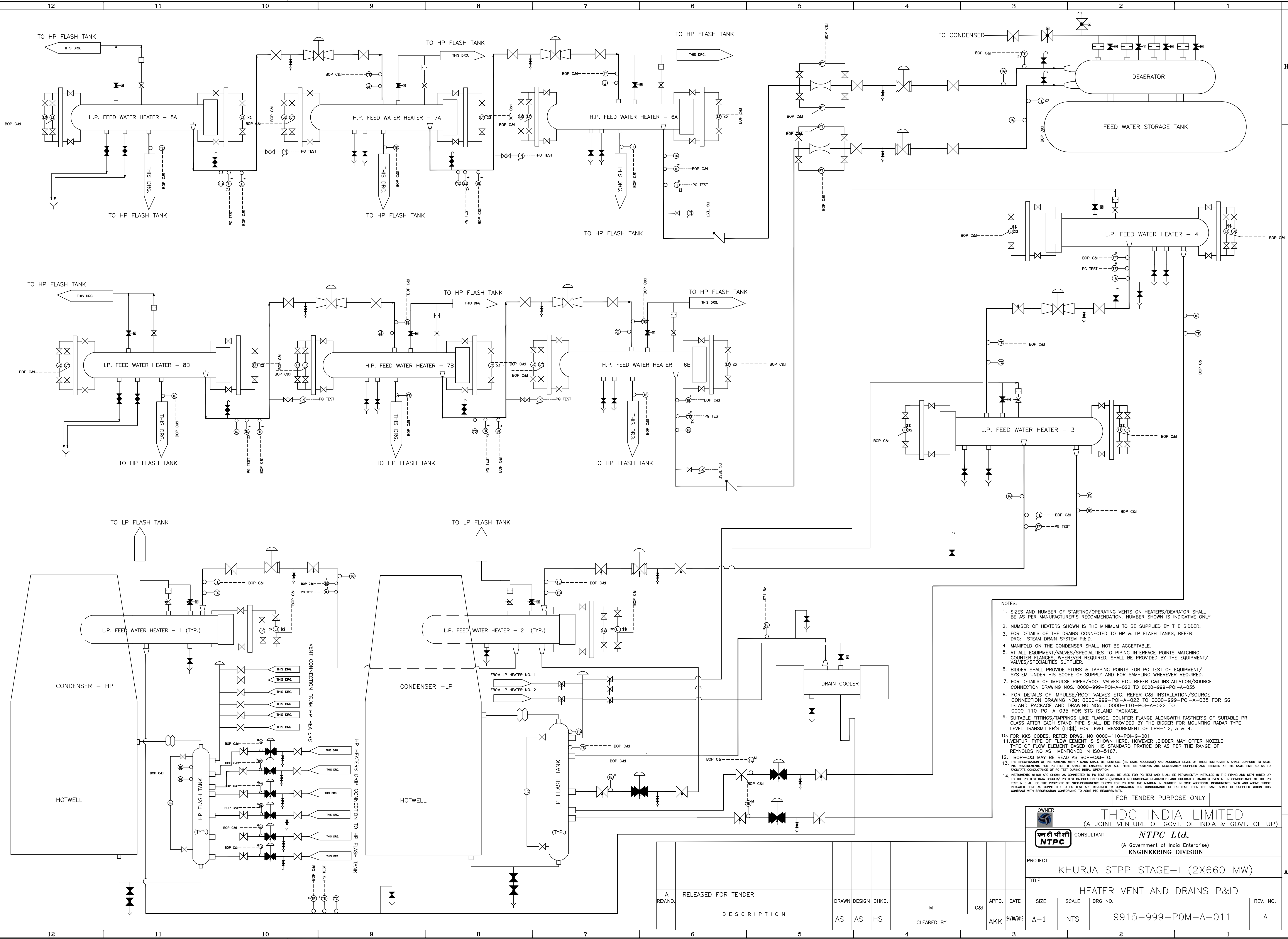
1. HIGH PRESSURE DRAINS ARE POWER CYCLE DRAINS WHICH ARE AT PRESSURE ABOVE AND INCLUDING HOT REHEAT PRESSURE. LOW PRESSURE DRAINS AND MEDIUM PRESSURE DRAINS ARE POWER CYCLE PIPING DRAIN WHICH ARE AT A PRESSURE BELOW HOT REHEAT PRESSURE.
2. EQUIPMENT/PIPING DRAINS INCLUDING DRAIN VALVES, PIPE, ORFICES, STRAINERS ETC. UPTO THE STUBS ON DRAIN MANIFOLDS ON THE FLASH TANKS SHALL BE IN THE SCOPE OF RESPECTIVE EQUIPMENT/PIPING SUPPLIER.
3. EMERGENCY DRAINS OF HP & LP HEATERS MAY BE LED TO THE CONDENSER THROUGH A SUITABLE ARRANGEMENT (SO THAT IT DOES NOT DAMAGE THE CONDENSER COMPONENTS AFTER FLASING) , PROVIDED IT IS A PROVEN PRACTICE OF THE SUPPLIER.
4. THE DRAINS SHOWN HERE ARE INDICATIVE ONLY. FINAL REQUIREMENT OF DRAIN CONNECTIONS TO FLASH TANK(S) / DRAIN MANIFOLD(S) INCLUDING DRAINS FROM PIPING/EQUIPMENT OF OTHER SUPPLIER SHALL BE DECIDED BASED ON PROCESS/LAYOUT CONSIDERATION DURING DETAILED ENGINEERING. ACCORDINGLY, NECESSARY STUBS ON THE FLASH TANK(S)/DRAIN MANIFOLDS SHALL BE PROVIDED BY THE SUPPLIER.
5. NUMBER OF MANIFOLDS AND BUNCHING OF DRAINS ON MANIFOLDS MAY BE CHANGED BASED ON PROCESS PARAMETERS.
6. IN ADDITION TO WHAT IS INDICATED IN THIS DRG. ALL THE REQUIREMENTS OF ASME-TDP (LATEST) SHALL BE DULY MET BY THE BIDDER. IN ADDITION, THE SUPPLIER SHALL INCLUDE THE SUPPLIES WHICH ARE AS PER SUPPLIERS STANDARD PRACTICE.
7. MINIMUM TWO NOS. OF STUBS ON EACH MANIFOLD ON EACH FLASH TANK SHALL BE PROVIDED BY THE TG SUPPLIER AS SPARE , AFTER FINALISATION OF TOTAL REQUIREMENT.
8. FOR DETAILS OF IMPULSE/ROOT VALVES ETC. REFER C&I INSTALLATION/SOURCE CONNECTION DRAWING NOS: 0000-999-PDI-A-022 TO 0000-999-PDI-A-035 FOR SG ISLAND PACKAGE AND DRAWING NOS : 0000-110-PDI-A-022 TO 0000-110-PDI-A-035 FOR STG ISLAND PACKAGE.
9. ALSO REFER DRG. NO. 9915-999-POM-A-004 TO 9915-999-POM-A-011

10. IN LIEU OF HP & LP FLASH TANKS, BIDDER MAY ALSO OFFER FLASH BOXES ATTACHED TO CONDENSER, IF IT IS A STANDARD AND PROVEN PRACTICE OF THE BIDDER. HOWEVER, NUMBER OF FLASH TANKS/ FLASH BOXES SHALL BE AS INDICATED IN THIS TENDER P&ID.
11. TEMPRATURE ELEMENTS (TE) TO BE PROVIDED AT THE DOWNSTREAM OF ALL REMOTE CONTROLLED ON/OFF DRAIN VALVES. TEMPERATURE ELEMENT IS TO BE CONNECTED TO CONTROL SYSTEM WHEREIN UPSTREAM DRAIN VALVE IS BEING CONNECTED.
12. FOR KKS CODES, REFER DRWG. NO 0000-110-PDI-G-001
13. BOP-C&I MAY BE READ AS BOP-C&I-TG.
14. THE MOTORISED VALVE IN DRAIN LINES HAVE BEEN SHOWN IN THIS P&ID. HOWEVER, BIDDER MAY OFFER PNEUMATIC VALVES IN DRAIN LINES, IF IT IS A STANDARD & PROVEN PRACTICE OF THE BIDDER.
15. SIZING OF ATMOSPHERIC FLASH TANK AND SPRAY WATER TO IT, SHALL BE DONE BY THE BIDDER SUCH THAT WASTE WATER, IF DRAINED TO OPEN PIT, ITS TEMPERATURE SHOULD NOT BE MORE THAN 60 DEG C.
16. THE SIZE OF DRAIN LINES SHALL NOT BE LESS THAN 40 NB.

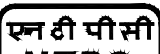
17. THE SPECIFICATION OF INSTRUMENTS WITH * MARK SHALL BE IDENTICAL (I.E. SAME ACCURACY) AND ACCURACY LEVEL OF THESE INSTRUMENTS SHALL CONFORM TO ASME PTC REQUIREMENTS FOR PG TEST. IT SHALL BE ENSURED THAT ALL THESE INSTRUMENTS ARE NECESSARILY SUPPLIED AND ERECTED AT THE SAME TIME SO AS TO FACILITATE CONDUCTANCE OF PG TEST DURING INITIAL OPERATION.
18. 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.

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 STEAM DRAIN SYSTEM P&ID	
SIZE A-1	SCALE NTS
DRG NO. 9915-999-POM-A-012	REV. NO. A

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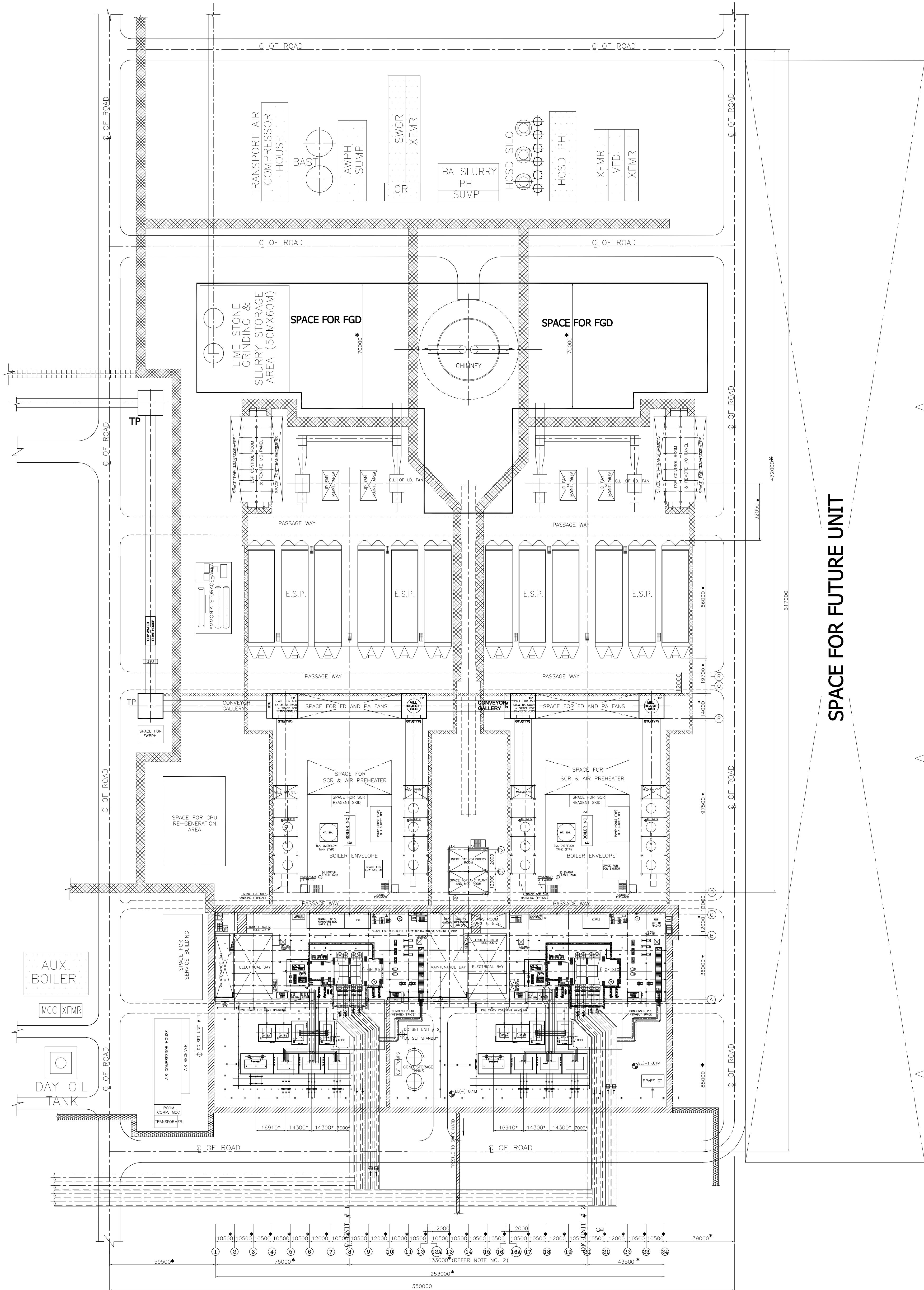
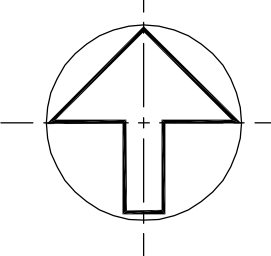


- NOTES:
1. SIZES AND NUMBER OF STARTING/OPERATING VENTS ON HEATERS/DEAERATOR SHALL BE AS PER MANUFACTURER'S RECOMMENDATION. NUMBER SHOWN IS INDICATIVE ONLY.
 2. NUMBER OF HEATERS SHOWN IS THE MINIMUM TO BE SUPPLIED BY THE BIDDER.
 3. FOR DETAILS OF THE DRAINS CONNECTED TO HP & LP FLASH TANKS, REFER DRG. STEAM DRAIN SYSTEM PAID.
 4. MANIFOLD ON THE CONDENSER SHALL NOT BE ACCEPTABLE.
 5. AT ALL EQUIPMENT/VALVES/SPECIALITIES TO PIPING INTERFACE POINTS MATCHING COUNTER FLANGES, WHEREVER REQUIRED, SHALL BE PROVIDED BY THE EQUIPMENT/VALVES/SPECIALITIES SUPPLIER.
 6. BIDDER SHALL PROVIDE STUBS & TAPPING POINTS FOR PG TEST OF EQUIPMENT/SYSTEM UNDER HIS SCOPE OF SUPPLY AND FOR SAMPLING WHEREVER REQUIRED.
 7. FOR DETAILS OF IMPULSE PIPES/ROOT VALVES ETC. REFER C&I INSTALLATION/SOURCE CONNECTION DRAWING NOS. 0000-999-POI-A-022 TO 0000-999-POI-A-035
 8. 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.
 9. SUITABLE FITTINGS/TAPPINGS LIKE FLANGE, COUNTER FLANGE ALONGWITH FASTNER'S OF SUITABLE PR CLASS AFTER EACH STAND PIPE SHALL BE PROVIDED BY THE BIDDER FOR MOUNTING RADAR TYPE LEVEL TRANSMITTERS (LTS) FOR LEVEL MEASUREMENT OF LPH-1,2, 3 & 4.
 10. FOR KKS CODES, REFER DRWG. NO 0000-110-POI-G-001
 11. 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.
 12. BOP-C&I MAY BE READ AS BOP-C&I-TG.
 13. 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.
 14. 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 LOGGING/ PG TEST CALCULATION SERVER (INDICATED IN FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES) SOON AFTER CONDUCTANCE OF THIS 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.

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 STPP STAGE-I (2X660 MW)			
TITLE			
HEATER VENT AND DRAINS P&ID			
SIZE	SCALE	DRG NO.	REV. NO.
A-1	NTS	9915-999-POM-A-011	A

A		RELEASED FOR TENDER		DRAWN		DESIGN	CHKD.	M		C&I	APPD.	DATE
REV.NO.		DESCRIPTION		AS	AS	HS		CLEARED BY		AKK	24/10/2018	

PLANT
NORTH



SPACE FOR FUTURE UNIT

NOTES:-

- THE LOCATION OF EQUIPMENT ARE INDICATIVE ONLY. THESE SHALL BE FURTHER ELABORATED DURING DETAILED ENGINEERING STAGE.
- UNIT PITCHING MAY VARY FROM 133m TO 142m. SAME SHALL BE DECIDED BY OWNER DURING DETAILED ENGINEERING, BASED ON SG ISLAND & TG ISLAND PACKAGES VENDOR DATA.
- LOCATION OF VERTICAL BRACINGS SHOWN HERE ARE INDICATIVE ONLY AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.
- NO PIPES, CABLES, STRUCTURES ARE TO BE PLACED BELOW 7.0M (BOP, BOC OR BOS) IN FRONT OF BOILER BETWEEN THE 12.0M CORRIDOR SEPARATING MAIN PLANT AND FIRST ROW OF BOILER COLUMNS (i.e. CD BAY) EXCEPT IN CONTROL TOWER AREA.
- LOCATION OF DOORS/REMOVABLE COVERS SHOWN IN THE DRAWINGS ARE INDICATIVE AND SHALL BE FINALISED DURING DETAILED ENGINEERING.
- ALL DIMENSIONS ARE IN MM'S AND LEVELS ARE IN METRES.
- FIRE BARRIER WALL IS PROVIDED ON A-ROW BETWEEN AXIS NO. 2-8&14-20.
- ALL ELEVATIONS INDICATED IN THE DRG ARE w.r.t. T.G. BUILDING GROUND FLOOR ELEVATION AS(+0.00M).
- a) FINISHED FLOOR OF PAVING SLAB IN BOILER/ESP/D FAN AREA SHALL BE (-)0.2M
- ii) FINISHED FLOOR ELEVATION IN MILL BAY AT GROUND LEVEL SHALL BE 0.00M.
- iii) FINISHED FLOOR LEVEL IN X-FMR YARD SHALL BE (-) 0.10M.
- iv) FINISHED FLOOR LEVEL INSIDE CHIMNEY SHALL BE 0.00M.
- v) FINISHED FLOOR LEVEL IN THE VARIOUS BUILDINGS IN MAIN PLANT AREA SHALL BE 0.00M.
8. ALL CABLE SPREADER ROOMS TO BE PROVIDED WITH DRAINAGE ARRANGEMENT.
9. BOTTOM OF STEEL OF PIPE / CABLE RACK IN MILL BAY AREA SHALL BE MINIMUM EL 17.0M.
10. FOR FLY ASH HANDLING EITHER VACUUM PUMPS OR EXTRACTION AIR COMPRESSORS SHALL BE PROVIDED.
11. IN CASE OF VACUUM PUMPS FOR DRY ASH SYSTEM, THESE SHALL BE LOCATED BELOW ESP NEAR IT'S 1ST FIELD AND THE SWGR. ROOM FOR THE SAME ALONG WITH TRANSFORMERS SHALL BE LOCATED IN ONE OF THE MAIN PLANT TP. IN CASE OF EXTRACTION AIR COMPRESSORS, THESE ALONG WITH SWGR. ROOM SHALL BE LOCATED IN AHP AREA.

- BRICK WALL REQUIREMENTS :
 - ALL STAIRCASES AT 'A' ROW & 'C' ROW SHALL BE PROVIDED WITH 230 mm THICK BRICK ENCLOSURE.
 - ALL CABLE SPREADER ROOM WALLS.
 - WALLS OF SWAS ROOM.
 - HT/LT SWITCH GEAR ROOMS, BOILER MCC ROOM.
 - AIR HANDLING UNITS(AHU).
 - OIL EQUIPMENT ROOM .
- RCC WALL : 250 mm THK RCC WALL FROM EL 0.0M TO 0.6M FOR LUBE OIL ROOM.
- D-ROW IS THE FIRST ROW OF BOILER AND MILL BAY COLUMNS.
- LOCATION AND SIZES OF TRANSFORMERS SHOWN IN TRANSFORMER YARD IS INDICATIVE ONLY.
- NO VERTICAL BRACING IN ELECTRICAL BAY AND I.P. BUS DUCT BAY SHALL BE PROVIDED.
- DIMENSION THUS (*) MARKED ARE INDICATIVE ONLY.
- NO. OF MILL REJECT SILO SHALL BE AS SPECIFIED IN THE SCOPE PORTION OF TECHNICAL SPECIFICATIONS.
- BIDDER SHALL ENSURE THAT NO FOOTING OF TRESTLE LEG TO BE PLANNED INSIDE THE SPACE FOR CPU REGENERATION AREA.
- SWAS ROOM DIMENSIONS ARE INDICATIVE ONLY.FURTHER DIMENSION SHALL BE FINALIZED DURING DETAILED ENGINEERING.
- EL(+/-) 0.0 M CORRESPONDS TO RL(+) 194.5 M

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OWNER	THDC INDIA LIMITED (A JV of GOVT. OF INDIA & GOVT. OF UP)
CONSULTANT	NTPC Limited (A GOVT. OF INDIA ENTERPRISE) CONSULTANCY WING
PROJECT	KHURJA SUPER THERMAL POWER PROJECT (2X860 MW PRESENT PROPOSAL + 1X860 MW FUTURE PROVISION)
TITLE	EQUIPMENT LAYOUT PLAN AT EL 0.0M (SIDE MILL ARRANGEMENT)
REV.	9915-999-POM-F-001

B	TO KEEP PROVISION FOR OPTIMISING LAYOUT OF GT	<i>Tighe</i>	AKR	AKR	AK	SA	VS	N.A	MT	KKV	SU	FZ	MS	SM	12.10.18
A	RELEASED FOR TENDER PURPOSE	<i>Tighe</i>	AKR	AKR	AK	SA	VS	N.A	MT	KKV	SU	FZ	MS	SM	23.10.18
REV.	DESCRIPTION	DRAWN	DESIGN	CHECK	L/O	TG	SG	LP	MH	WS	E	C	C&I	APPO	DATE
CLEARED BY															



12. BRICK WALL REQUIREMENTS :
 - i) ALL STAIRCASES AT 'A' ROW & 'C' ROW SHALL BE PROVIDED WITH 230 mm THICK BRICK ENCLOSURE.
 - ii) ALL CABLE SPREADER ROOM WALLS.
 - iii) WALLS OF SWAS ROOM.
 - iv) HT/LT SWITCH GEAR ROOMS, BOILER MCC ROOM.
 - v) AIR HANDLING UNITS(AHU).
 - vi) OIL EQUIPMENT ROOM .
13. RCC WALL : 250 mm THK RCC WALL FROM EL.0.0M TO 0.6M FOR LUBE OIL ROOM.
14. D-ROW IS THE FIRST ROW OF BOILER AND MILL BAY COLUMNS.
15. LOCATION AND SIZES OF TRANSFORMERS SHOWN IN TRANSFORMER YARD IS INDICATIVE ONLY.
16. NO VERTICAL BRACING IN ELECTRICAL BAY AND I.P. BUS DUCT BAY SHALL BE PROVIDED.
17. DIMENSION THRU (*) MARKED ARE INDICATIVE ONLY.
18. NO. OF MILL REJECT SILE SHALL BE AS SPECIFIED IN THE SCOPE PORTION OF TECHNICAL SPECIFICATIONS.
19. BIDDER SHALL ENSURE THAT NO FOOTING OF TRESTLE LEG TO BE PLANNED INSIDE THE SPACE FOR CPU REGENERATIVE AREA.
20. SWAS ROOM DIMENSIONS ARE INDICATIVE ONLY.FURTHER DIMENSION SHALL BE FINALIZED DURING DETAILED ENGINEERING.
21. $EL(+/-) 0.0 \text{ M}$ CORRESPONDS TO $RL(+/-) 194.5 \text{ M}$

cad file name : 9915-999-POM-F-0040wg. (23-04-2018)



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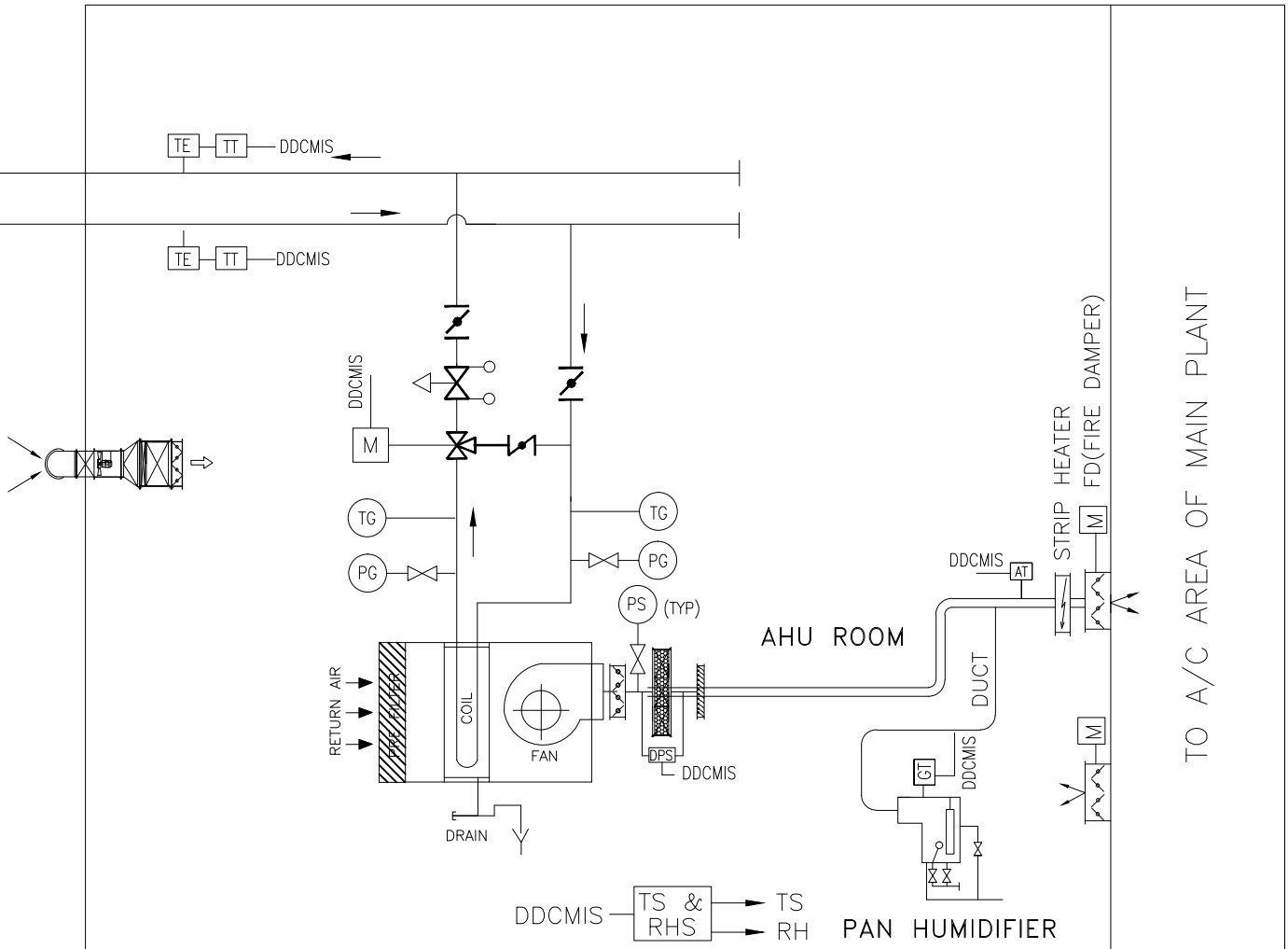
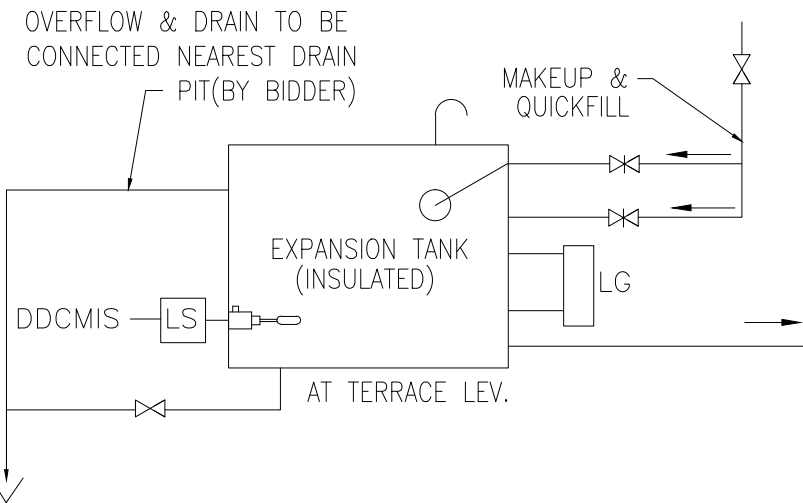
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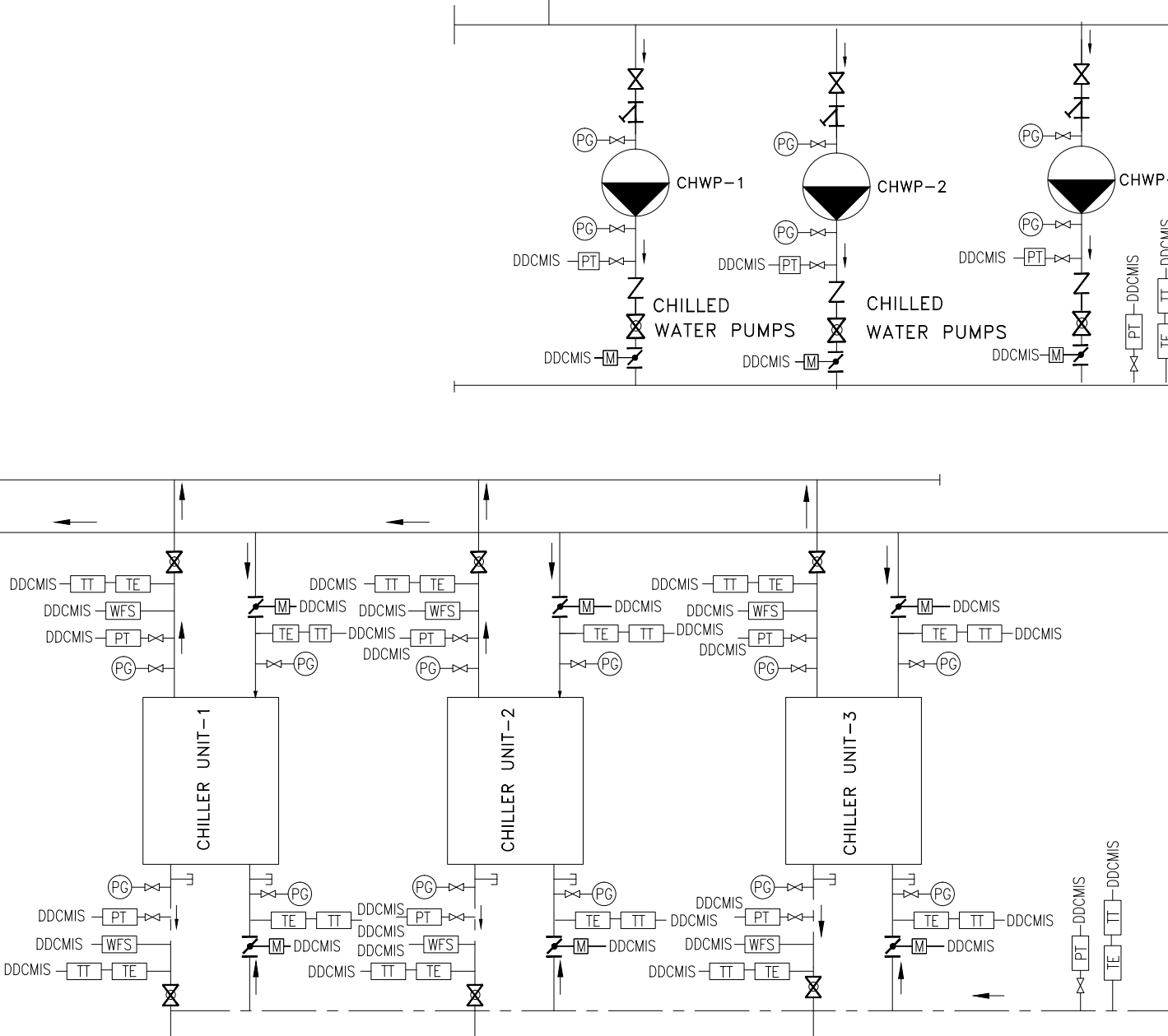
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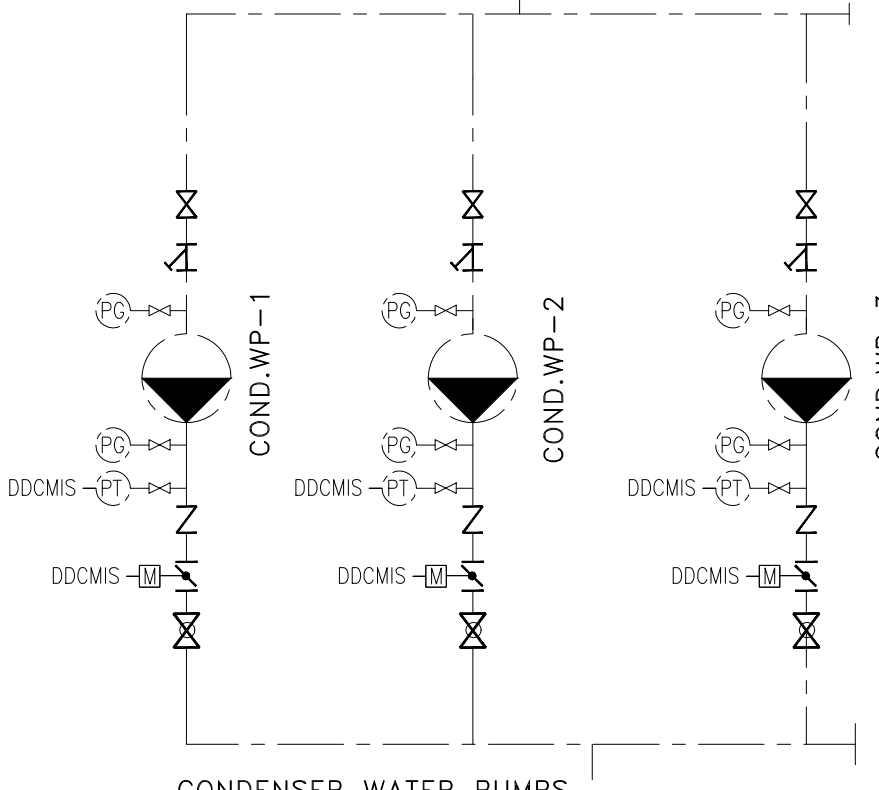
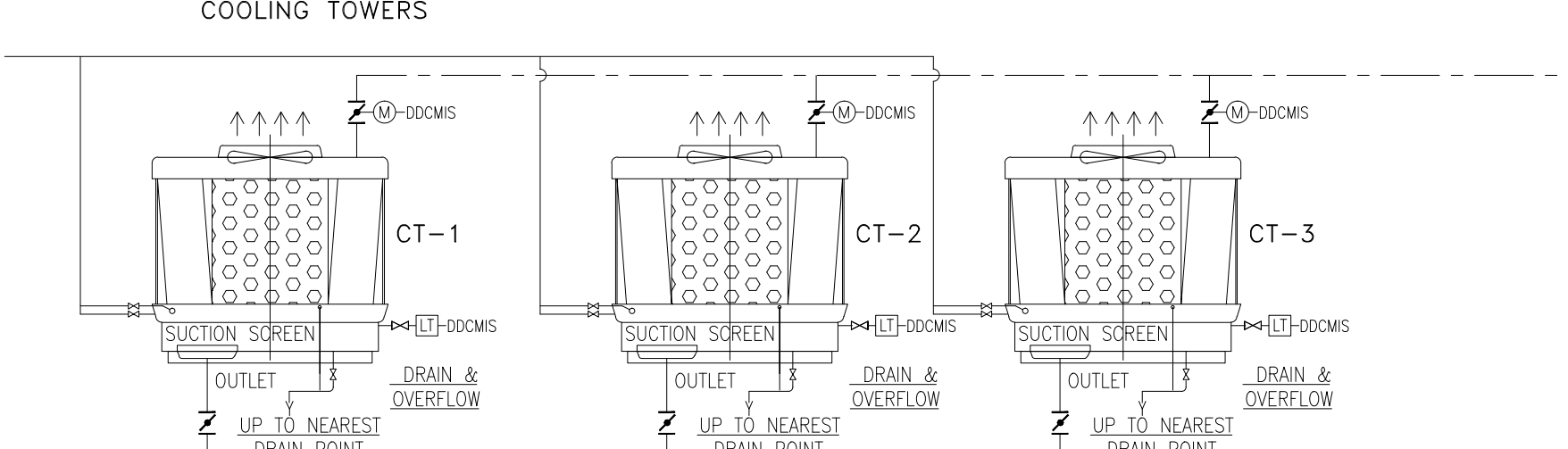
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TYPICAL CONNECTION DETAIL FOR AHU ROOM



A/C PLANT ROOM OF MAIN PLANT TG BUILDING



CONDENSER WATER PUMP

CHILLED WATER PUMP DETAIL	
NAME	QTY
CHWP-1 TO 3	3 NOS(2W+1S/R)

CONDENSER WATER PUMP DETAIL	
NAME	QTY
COND WP-1 TO 3	3 NOS (2W+1S (P))

COOLING TOWER DETAILS	
NAME	QTY
CT-1 TO 3	3 NOS (2W+1S /P)

	TEMPERATURE TRANSMITTER)
	CH.WATER SUPPLY & RETURN PIPE
	COND.WATER SUPPLY & RETURN PIPE
	OPEN DRAIN PIT
	ATMOSPHERIC VENT
	DESCALING CONNECTION
	STRIP HEATER
	FRESH AIR FAN WITH PRE FILTER & FINE FILTER
	CENTRIFUGAL FAN
	PUMP
	PAN HUMIDIFIER WITH 25NB GATE VALVE(3 NOS EACH), NO EACH FLOAT VALVE, M-U/P,O,FILL & DRAIN CON.
	TEMPERATURE GAUGE
	LEVEL GAUGE
	LEVEL TRANSMITTER
	LEVEL SWITCH
	GEYSER STAT
	AIR STAT
	DIFFERENTIAL PRESSURE SWITCH
	WATER FLOW SWITCH
	RH SENSOR &TEMP.SENSOR
	TEMPERATURE ELEMENT(SENSOR)
	PRESSURE TRANSMITTER
	PRESSURE GAUGE
	HEPA FILTER
	FINE FILTER
	PRE FILTER
	ML TYPE FINE DAMPER(MOTORISED)
	VOLUME CONTROL DAMPER (ML TYPE)
	NON RETURN DAMPER (ML TYPE)
	FLOW CONTROL VALVE
	GATE VALVE
	FLOAT VALVE
	MOTORIZED GLOBE VALVE(INCHING TYPE)
	BALANCING VALVE
	3 WAY VALVE (MODULATING WITH ACTUATOR)
	GLOBE VALVE
	CHECK VALVE
	“Y” STRAINER
	BUTTERFLY VALVE(MOTORISED)
	BUTTERFLY VALVE
LEGEND	DESCRIPTION

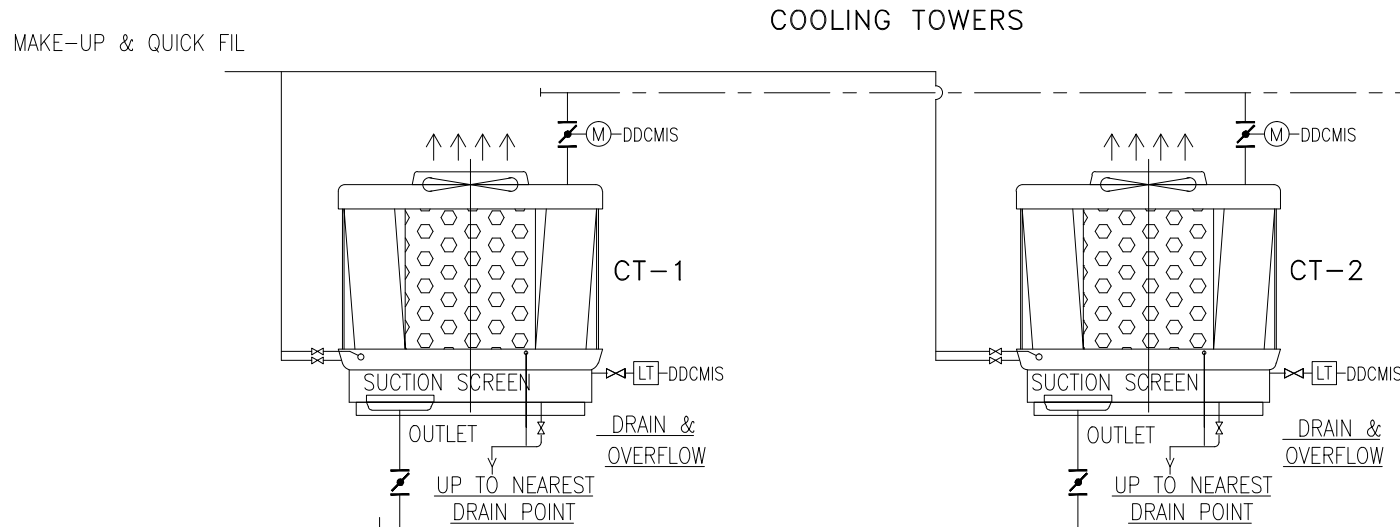
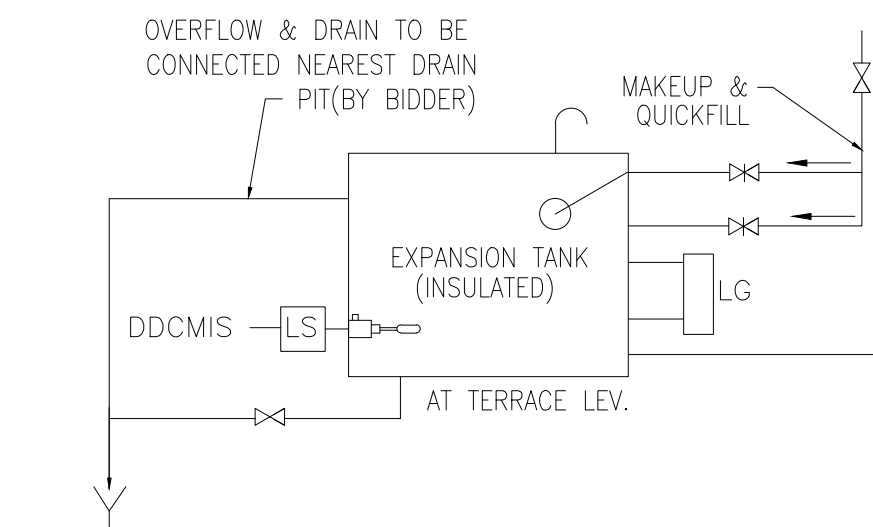
NOTE

- 1) CAPACITY OF ALL TH/O/C EQUIPMENTS SHALL BE FINALISED DURING DETAILED ENGINEERING.
- 2) SIZE OF PIPES, VALVES ETC SHALL BE FINALISED DURING DETAILED ENGINEERING
- 3) NUMBER OF AHU AND AHU CAPACITY SHALL BE FINALISED DURING DETAILED ENGINEERING
- 4) CHILLED WATER PUMPS, PIPING, VALVES, EXPANSION TANK, AHU-DRAIN ETC. SHALL BE INSULATED AS PER SPECIFICATION.
- 5) ALL PIPING & VALVES OF SIZE 40 NB & BELOW SHALL BE PROVIDED AS PER SYSTEM REQUIREMENT BY THE BIDDER.
- 6) FOR FLOW BALANCING, BALANCING VALVE AND ORIFICE PLATE SHALL BE PROVIDED BY BIDDER AS PER SYSTEM REQUIREMENT.
- 7) 1X100% CAPACITY FRESH AIR FAN SHALL BE PROVIDED IN EACH AHU ROOM
- 8) TEMPERATURE SENSOR (TS) & RELATIVE HUMIDITY SENSOR (RHS) SHALL BE PROVIDED IN EACH AHU ROOM.
- 9) AIR RELEASE VALVES AS PER SYSTEM REQUIREMENT SHALL BE PROVIDED AT SUITABLE LOCATIONS.

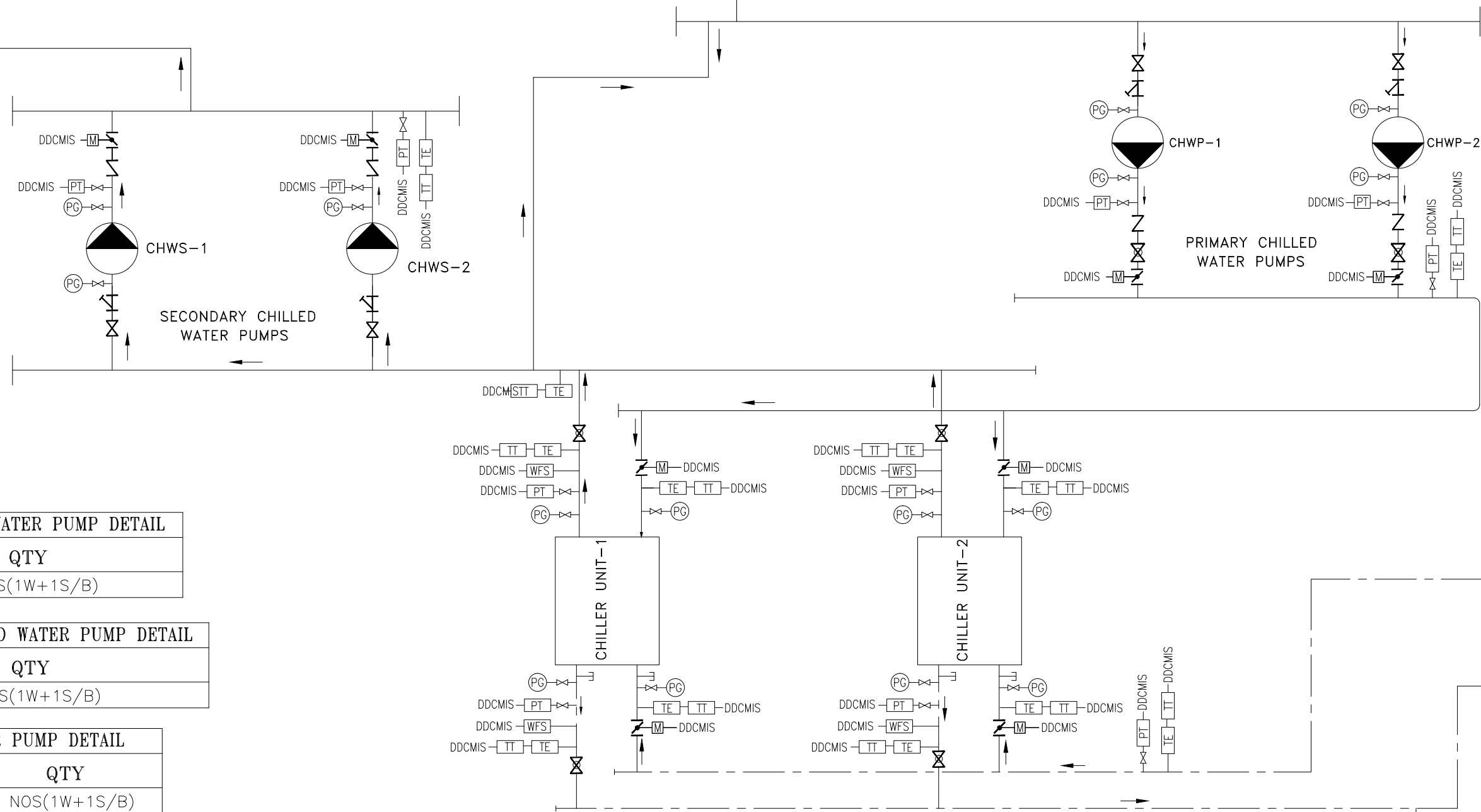
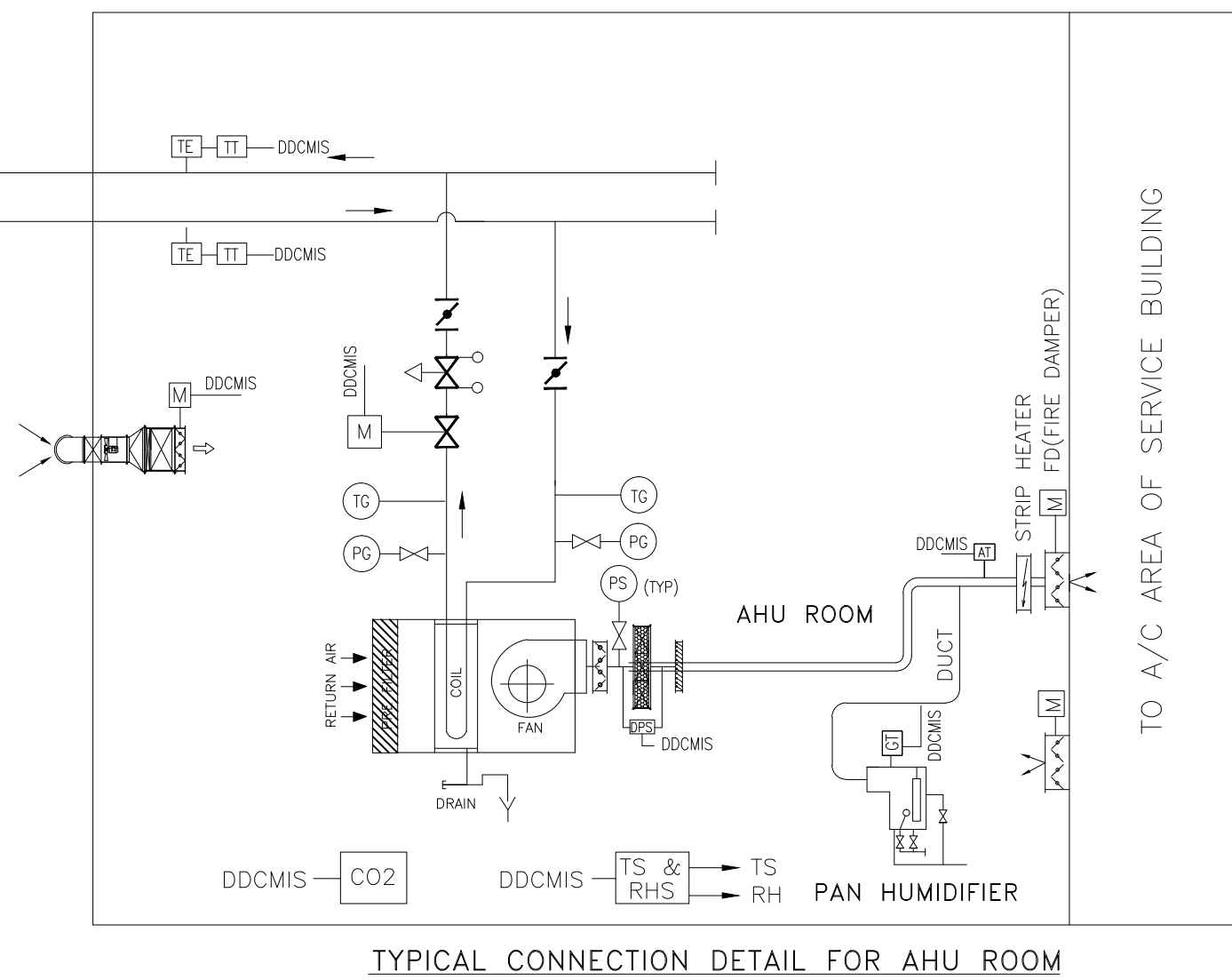
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CLIENT  THDC INDIA LIMITED (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)			
CONSULTANT एन टी सी NTPC		एन टी सी लिमिटेड NTPC Limited (A GOVT. OF INDIA ENTERPRISE) ENGINEERING DIVISION	
PROJECT K UR A SUPER T ERMAL PO ER PRO ECT STAGE-I (2x660MW)			
TITLE SCHEMATIC DIAGRAM FOR A/C SYSTEM FOR MAIN PLANT TG BUILDING			
SIZE A1	SCALE NTS	DRG.NO. 9915-002-POM-A-054	REV 01

CAD FILE NAME : 9915-002-POM-A-054



TO OTHER AHU ROOMS



PRIMARY CHILLED WATER PUMP DETAIL	
NAME	QTY
CHWP-1 TO 2	2 NOS(1W+1S/B)

SECONDARY CHILLED WATER PUMP DETAIL	
NAME	QTY
CHWS-1 TO 2	2 NOS(1W+1S/B)

CONDENSER WATER PUMP DETAIL	
NAME	QTY
COND.WP-1 TO 2	2 NOS(1W+1S/B)

COOLING TOWER DETAILS	
NAME	QTY
CT-1 TO 2	2 NOS(1W+1S/B)

A/C PLANT ROOM OF SERVICE BUILDING

LEGEND	DESCRIPTION
	HEPA FILTER
	FINE FILTER
	PRE FILTER
	ML TYPE FIRE DAMPER(MOTORISED)
	VOLUME CONTROL DAMPER (ML TYPE)
	NON RETURN DAMPER (ML TYPE)
	FLOW CONTROL VALVE
	GATE VALVE
	FLOAT VALVE
	MOTORIZED GLOBE VALVE(INCHING TYPE)
	BALANCING VALVE
	2 WAY VALVE (MODULATING WITH ACTUATOR)
	GLOBE VALVE
	CHECK VALVE
	Y' STRAINER
	BUTTERFLY VALVE(MOTORISED)
	BUTTERFLY VALVE
	LEGEND

LEGEND	DESCRIPTION
	TEMPERATURE TRANSMITTER)
	CH.WATER SUPPLY & RETURN PIPE
	COND.WATER SUPPLY & RETURN PIPE
	OPEN DRAIN PIT
	ATMOSPHERIC VENT
	DESCALING CONNECTION
	STRIP HEATER
	FRESH AIR FAN WITH PRE FILTER & FINE FILTER
	CENTRIFUGAL FAN
	PUMP
	PAN HUMIDIFIER WITH 25NB GATE VALVE(3 NOS EACH), NO EACH FLOAT VALVE, M-UP/Q-FILL & DRAIN CON.
	TEMPERATURE GAUGE
	LEVEL GAUGE
	LEVEL TRANSMITTER
	LEVEL SWITCH
	GEYSER STAT
	AIR STAT
	DIFFERENTIAL PRESSURE SWITCH
	WATER FLOW SWITCH
	RH SENSOR &TEMP.SENSOR
	TEMPERATURE ELEMENT(SENSOR)
	PRESSURE TRANSMITTER
	PRESSURE GAUGE
	LEGEND

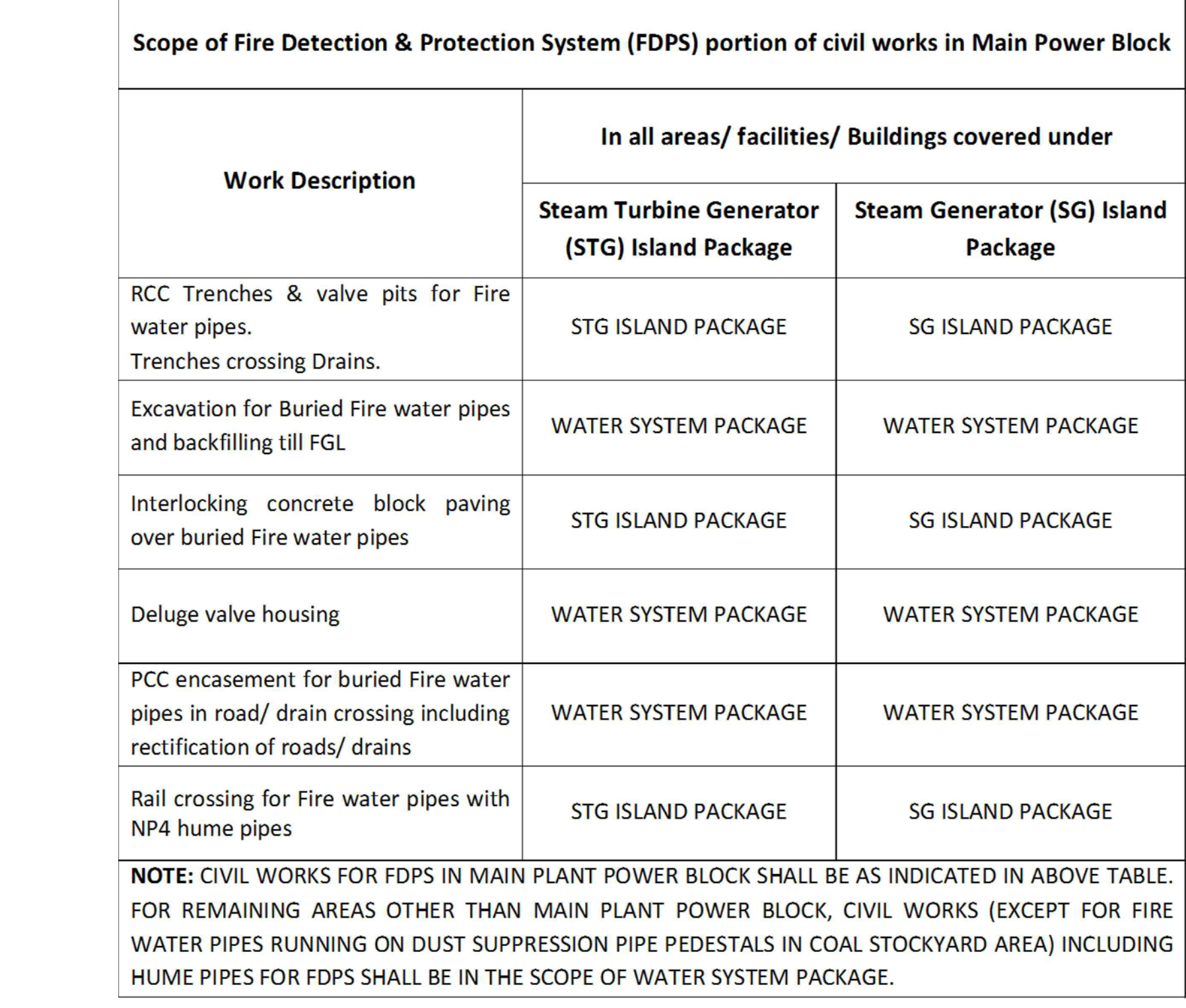
NOTE

- 1) CAPACITY OF ALL THE A/C EQUIPMENTS SHALL BE FINALISED DURING DETAILED ENGINEERING BASED ON HEAT LOAD CALCULATION OF SERVICE BUILDING
- 2) SIZE OF PIPES, VALVES ETC SHALL BE FINALISED DURING DETAILED ENGINEERING
- 3) NUMBER OF AHU AND AHU CAPACITY SHALL BE FINALISED DURING DETAILED ENGINEERING BASED ON THE FINILASIED ARCHITECTURAL DRAWING OF THE SERVICE BUILDING
- 4) VARIABLE AIR VOLUME BOX (VAV) SHALL BE PROVIDED FOR OPTIMUM USE OF AHU THROUGH WWWFD. NUMBERS OF VAV BOX SHALL BE FINALISED DURING DETAILED ENGINEERING. VAV BOX SHALL BE REGULATED BY TEMPERATURE SENSOR & OCCUPANCY SENSOR PROVIDED IN RESPECTIVE ROOMS.
- 5) SECONDARY CHILLED WATER PUMPS, COOLING TOWER FANS, AHU SHALL BE VWVFD
- 6) CHILLED WATER PUMPS, PIPING, VALVES,EXPANSION TANK, AHU-DRAIN ETC. SHALL BE INSULATED AS PER SPECIFICATION.
- 7) ALL PIPING & VALVES OF SIZE 40 NB & BELOW SHALL BE PROVIDED AS PER SYSTEM REQUIREMENT BY THE BIDDER.
- 8) FOR FLOW BALANCING, BALANCING VALVE AND ORIFICE PLATE SHALL BE PROVIDED BY BIDDER AS PER SYSTEM REQUIREMENT.
- 9) TEMPERATURE SENSOR (TS) & RELATIVE HUMIDITY SENSOR (RHS) SHALL BE PROVIDED IN EACH AHU ROOM.
- 10) AIR RELEASE VALVES AS PER SYSTEM REQUIREMENT SHALL BE PROVIDED AT SUITABLE LOCATIONS.
- 11) ALL WATER PIPES SHALL BE AS PER TECHNICAL SPECIFICATION.

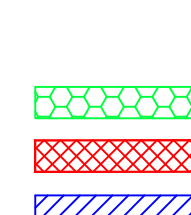
FOR TENDER PURPOSE ONLY

CLIENT	THDC INDIA LIMITED (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)	
CONSULTANT	एन टी सी लिमिटेड NTPC Limited (A GOVT. OF INDIA ENTERPRISE) ENGINEERING DIVISION	
PROJECT	K UR A SUPERT ERMAL PO ER PRO ECT STAGE - I (2x660MW)	
TITLE	SCHEMATIC DIAGRAM FOR A/C SYSTEM FOR SERVICE BUILDING	
SIZE	SCALE	DRG.NO.
A1	NTS	9915-002-POM-A-056
REV.	01	

CAD FILE NAME : 9915-002-POM-A-056



- ## FIRE FIGHTING—LEGEND

1. HYDRANT LINE RING NO.1(MAIN PLANT)	
2. HYDRANT LINE RING NO.2	
3. SPRAY LINE	
4. HYDRANT BOOSTER LINE	
5. SPRAY BOOSTER LINE	
6. ISOLATION VALVE (GATE VALVE) NORMALLY OPEN	
7. FIRE WATER PIPES ON TRESTLE (IN WS PACKAGE SCOPE) TRESTLE (IN SG PACKAGE SCOPE) TRESTLE (IN TG PACKAGE SCOPE)	
8. FIRE WATER PIPES IN TRENCH	
9. UNDER GROUND (BURIED) FIRE WATER PIPES	
10. FIRE WATER PIPES ON PEDESTALS	

Scope of Fire Detection & Protection System (FDPS) portion of civil works in Main Power Block		
Work Description	In all areas/ facilities/ Buildings covered under	
	Steam Turbine Generator (STG) Island Package	Steam Generator (SG) Island Package
RCC Trenches & valve pits for Fire water pipes. Trenches crossing Drains.	STG ISLAND PACKAGE	SG ISLAND PACKAGE
Excavation for Buried Fire water pipes and backfilling till FGL	WATER SYSTEM PACKAGE	WATER SYSTEM PACKAGE
Interlocking concrete block paving over buried Fire water pipes	STG ISLAND PACKAGE	SG ISLAND PACKAGE
Deluge valve housing	WATER SYSTEM PACKAGE	WATER SYSTEM PACKAGE
PCC encasement for buried Fire water pipes in road/ drain crossing including rectification of roads/ drains	WATER SYSTEM PACKAGE	WATER SYSTEM PACKAGE
Rail crossing for Fire water pipes with NP4 hume pipes	STG ISLAND PACKAGE	SG ISLAND PACKAGE

NOTE: CIVIL WORKS FOR FDPS IN MAIN PLANT POWER BLOCK SHALL BE AS INDICATED IN ABOVE TABLE. FOR REMAINING AREAS OTHER THAN MAIN PLANT POWER BLOCK, CIVIL WORKS (EXCEPT FOR FIRE WATER PIPES RUNNING ON DUST SUPPRESSION PIPE PEDESTALS IN COAL STOCKYARD AREA) INCLUDING HUME PIPES FOR FDPS SHALL BE IN THE SCOPE OF WATER SYSTEM PACKAGE.

NOTE: CIVIL WORKS FOR FDPDS IN MAIN PLANT POWER BLOCK SHALL BE AS INDICATED IN ABOVE TABLE. FOR REMAINING AREAS OTHER THAN MAIN PLANT POWER BLOCK, CIVIL WORKS (EXCEPT FOR FIRE WATER PIPES RUNNING ON DUST SUPPRESSION PIPE PEDESTALS IN COAL STOCKYARD AREA) INCLUDING HUME PIPES FOR FDPDS SHALL BE IN THE SCOPE OF WATER SYSTEM PACKAGE.

FOR TENDER PURPOSE ONLY

OWNER		 THDC INDIA LIMITED (A JV OF GOVT. OF INDIA & GOVT. OF UP)	
CONSULTANT		 NTPC Limited (A GOVT. OF INDIA ENTERPRISE) CONSULTANCY WING	
PROJECT		KHURJA SUPER THERMAL POWER PROJECT (2 X 660 MW)	
TITLE		FIRE DETECTION & PROTECTION SYSTEM LAYOUT OF FIRE HYDRANT & SPRAY MAINS	
SIZE A0	SCALE NTS	(DRG NO.) 9915-999-POM-A-046	REV. A
		2	1

A	RELEASED FOR TENDOR PURPOSE														TARUN	KV	KV	SJ										SKJ	24-7-18														
REV.	DESCRIPTION														DRAWN	DESIGN	CHKD	PU	L/O	SG	LP	MH	WS	E	C	CDI	APPD	DATE															
														Cleared By _____																													
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NOTES:

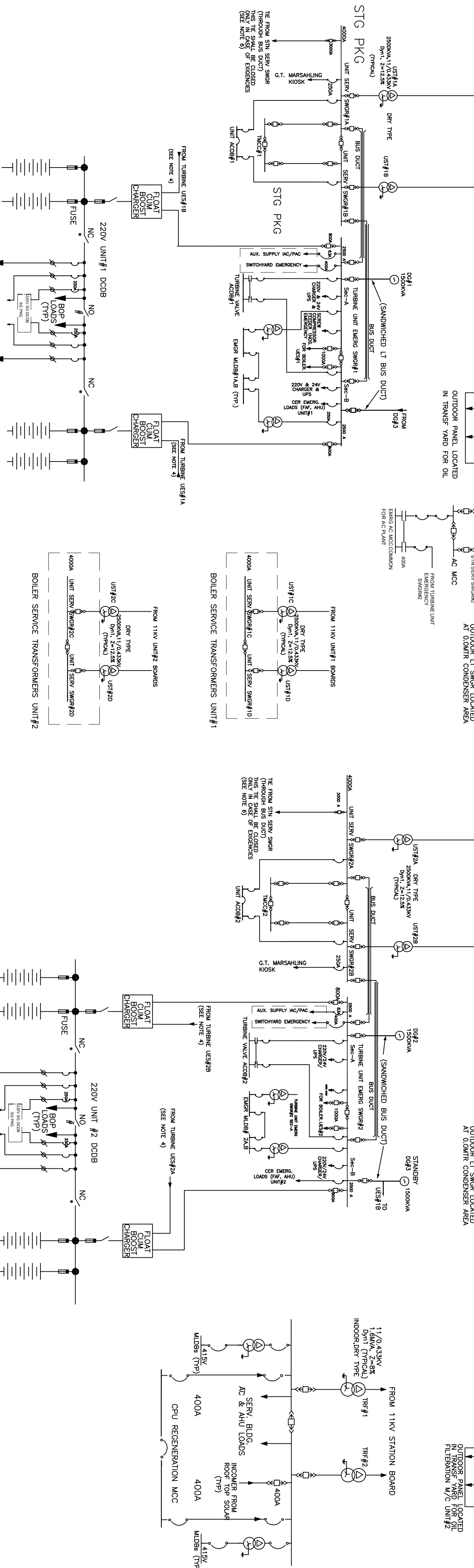
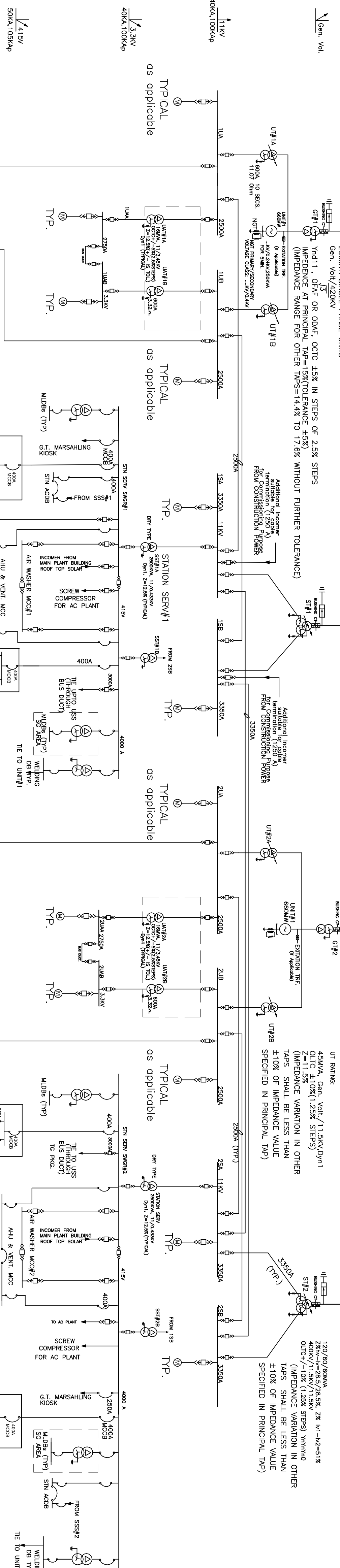
- ONE PRESS, GENERATOR PROVIDED BY OWNER PER UNIT IS CONNECTED TO THE RESPECTIVE FEEDER BUS. STANDBY OF THE STANDBY OF ONE UNIT AT A TIME. UNITS IS PROVIDED TO CATER THE EMERGENCY REQUIREMENT OF ONE UNIT AT A TIME.
- CHANGEOVER FACILITY
 - 11KV SYSTEM UNIT BUSES EMPLOY FAST BUS TRANSFER SCHEME FOR SUPPLY FAILURE FROM THE RESPECTIVE UNIT TRANSFORMER AND SLOW AUTO SUPPLY CHANGEOVER WITH CHECK SYNCHRONISATION AND SLOW AUTO CHANGEOVER FACILITY AS A BACK-UP IS ALSO PROVIDED FOR THESE BUSES.
 - 11KV SYSTEM UNIT BUSES EMPLOY FAST BUS TRANSFER SCHEME FOR SUPPLY FAILURE FROM THE RESPECTIVE UNIT TRANSFORMER AND SLOW AUTO SUPPLY CHANGEOVER WITH CHECK SYNCHRONISATION AND SLOW AUTO CHANGEOVER FACILITY AS A BACK-UP IS ALSO PROVIDED FOR THESE BUSES.
 - ALL 415V SYSTEM BUS INCOMERS FED FROM TRANSFORMERS ARE PROVIDED WITH MANUAL LIVE/DEAD BUS CLOSING FACILITY.
 - UNIT 415V BUS SECTIONS ARE ADDITIONALLY PROVIDED WITH MANUAL AUTOMATIC CHANGEOVER, WITH THEIR RESPECTIVE DG BUS.
 - 415V EMERGENCY BOARDS ARE NORMALLY FED FROM RESPECTIVE UNIT LV BOARDS. IN THE EVENT OF FAILURE OF NORMAL POWER SUPPLY, MAIN AND STANDBY DG WILL AUTOSTART SIMULTANEOUSLY AND BE CLOSED AUTOMATICALLY. THE EMERGENCY BOARD AND STANDBY DG INCOMER IF REQUIRED WILL BE CLOSED MANUALLY.
- THE SELECTION OF LT FEEDERS SHALL BE AS INDICATED BELOW:
 - UP TO 400 A – MCCB
 - ABOVE 400 A – BREAKER
- EACH MAIN PLANT DC SYSTEM SHALL BE FED THROUGH TWO NOS. DC BATTERY AND TWO NOS. FLOAT CUM BOOST CHARGERS AS INDICATED. EACH BATTERY SHALL HAVE RATING OF 2X900AH IN CASE OF N-CD OR 2X1500AH FOR LEAD ACID BATTERIES. EACH DC CHARGER SHALL BE RATED FOR 220V DC. 800AMP.
- CONTROL AND PROTECTION SUPPLIES FOR ALL SWITCHGEARS/DGS/CONTROL PANELS SHALL BE FED FROM TWO DIFFERENT SOURCES/DIFFERENT SECTIONS.
- IPB FAULT LEVEL:
 - FAULT LEVEL SHALL BE DEDUCED BASED ON GENERATOR/LT PARAMETERS AND 400KV SYSTEM FAULT OF 50 KA, 1 SEC.
- OWNER'S REQUIREMENT TO BE CONSIDERED IN CONJUNCTION WITH SCOPE CHAPTER.
- ALL ROOTPO SOLAR INCOMER FEEDER SHALL HAVE 0.2s CLASS METERING
- SUPPLY, ERECTION, TESTING AND COMMISSIONING OF 420KV, 125MVAR BUS REACTOR AND 420KV, 800MVAR LINE REACTOR IS IN BIDDERS SCOPE. HOWEVER RELATED CIVIL WORKS ARE NOT IN SCOPE OF THIS PACKAGE.
- ALL GT, ST, UT, 400KV BUS REACTOR AND ALL INDOOR TRANSFORMER INDICATED IN TENDER SLD ARE IN BIDDERS SCOPE. NGR FOR TRANSFORMERS UNDER BIDDERS SCOPE (WHEREVER APPLICABLE) ARE ALSO INCLUDED IN BIDDERS SCOPE OF SUPPLY.
- SUPPLY, ERECTION AND COMMISSIONING OF LT, LT AND CONTROL CABLES FOR ALL CASES WHERE EQUIPMENTS ON BOTH SIDES ARE UNDER SCOPE OF THIS PACKAGE ARE INCLUDED IN SCOPE OF THIS PACKAGE.
- SIZING OF POWER/INDOOR TRANSFORMERS,DG SET AND DC SYSTEM IS EXCLUDED FROM BIDDERS SCOPE. RATINGS FOR THE EQUIPMENTS ARE AS INDICATED IN THIS SLD.
- RATINGS AND QUANTITY OF REACTORS INDICATED AT NOTE NO. 9 ABOVE IS TENTATIVE AND SHALL BE FINALIZED DURING DETAILED ENGINEERING. NECESSARY UNIT RATE FOR REACTOR OF BOTH RATINGS SHALL BE PROVIDED BY BIDDER IN BPS FOR QUANTITY VARIATION BASED ON ACTUAL QUANTITY AND RATING SUPPLIED FOR THE PROJECT.
- ITEMS INSIDE BOX ARE EXCLUDED FROM BIDDERS SCOPE

OVERHEAD CONNECTION TO SWITCHYARD

OVERHEAD CONNECTION TO SWITCHYARD

OVERHEAD CONNECTION TO SWITCHYARD

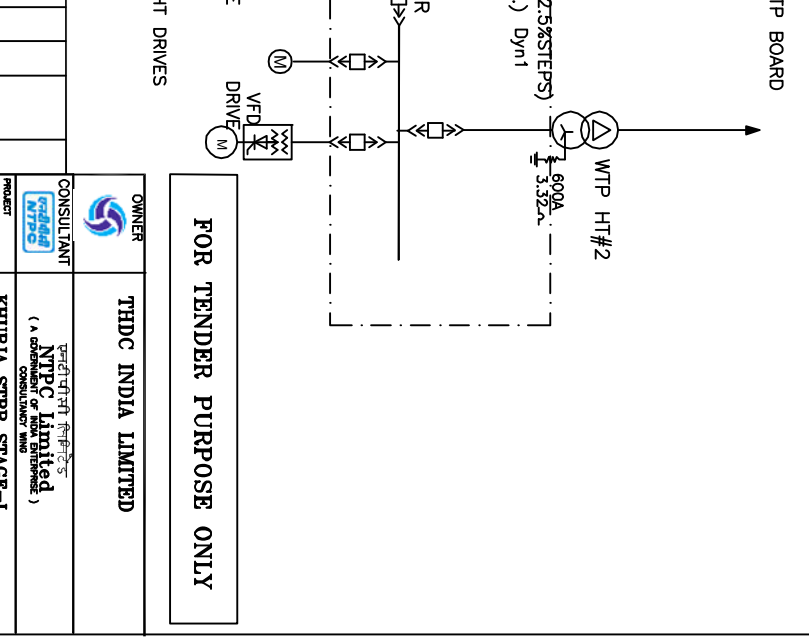
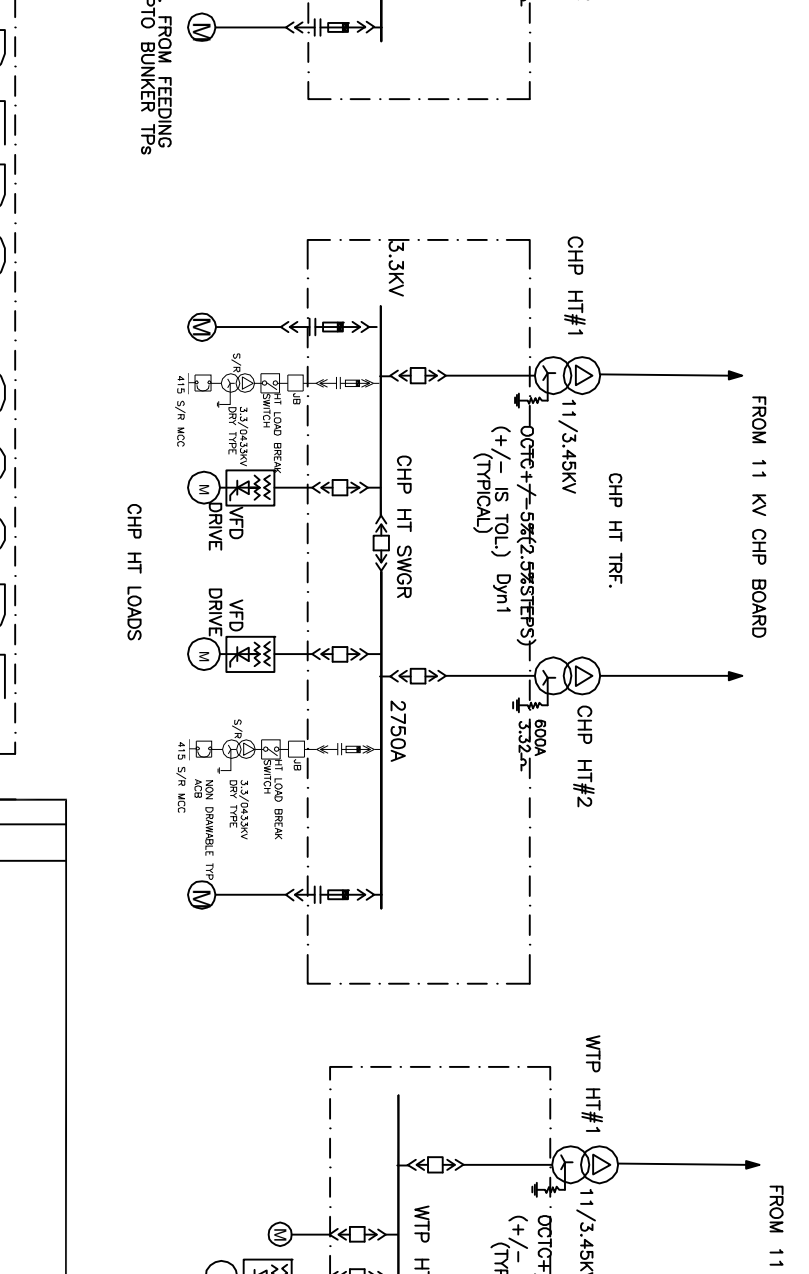
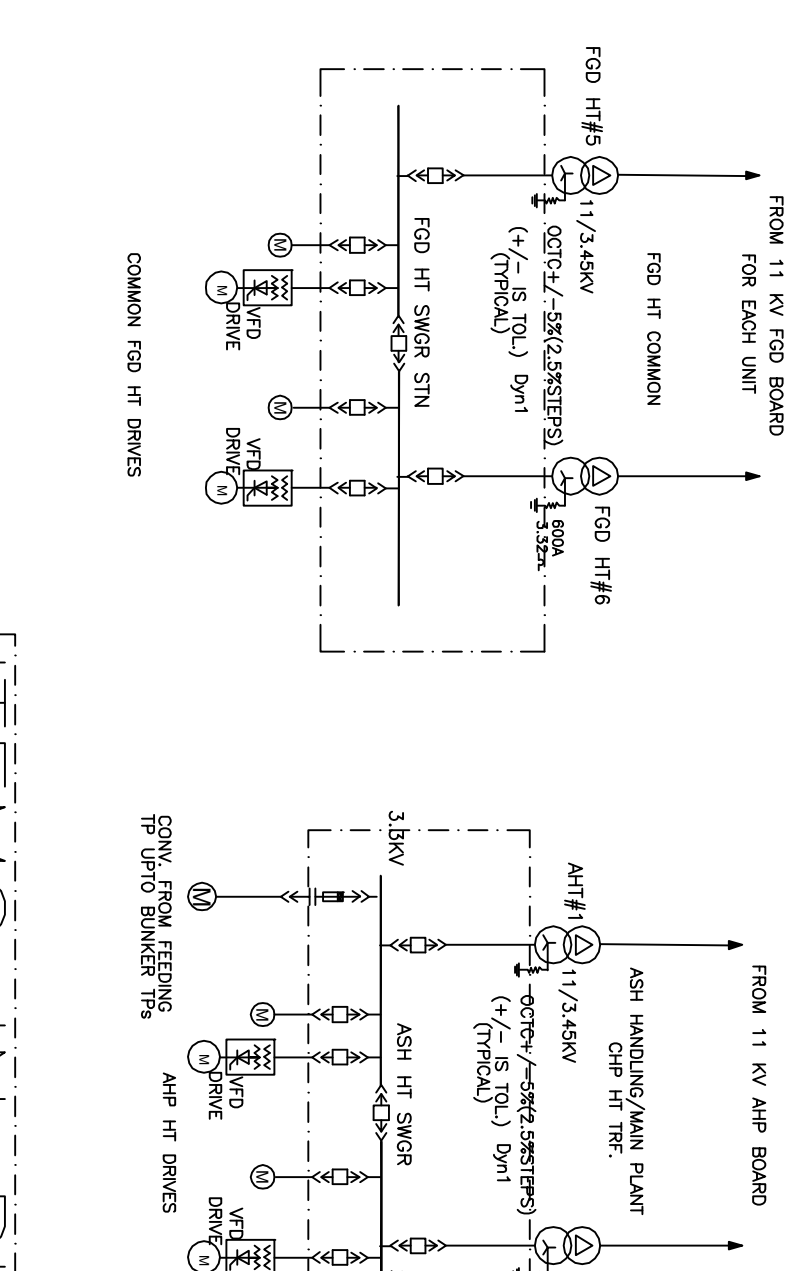
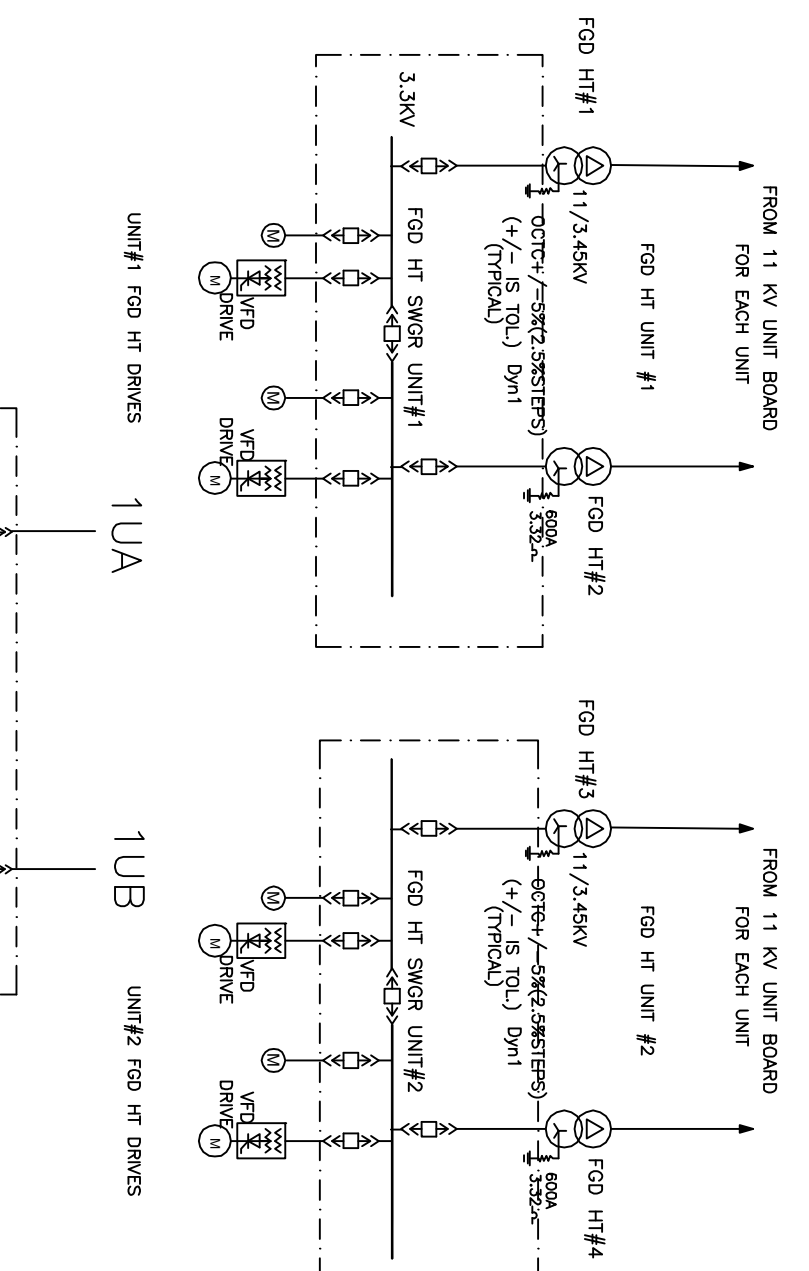
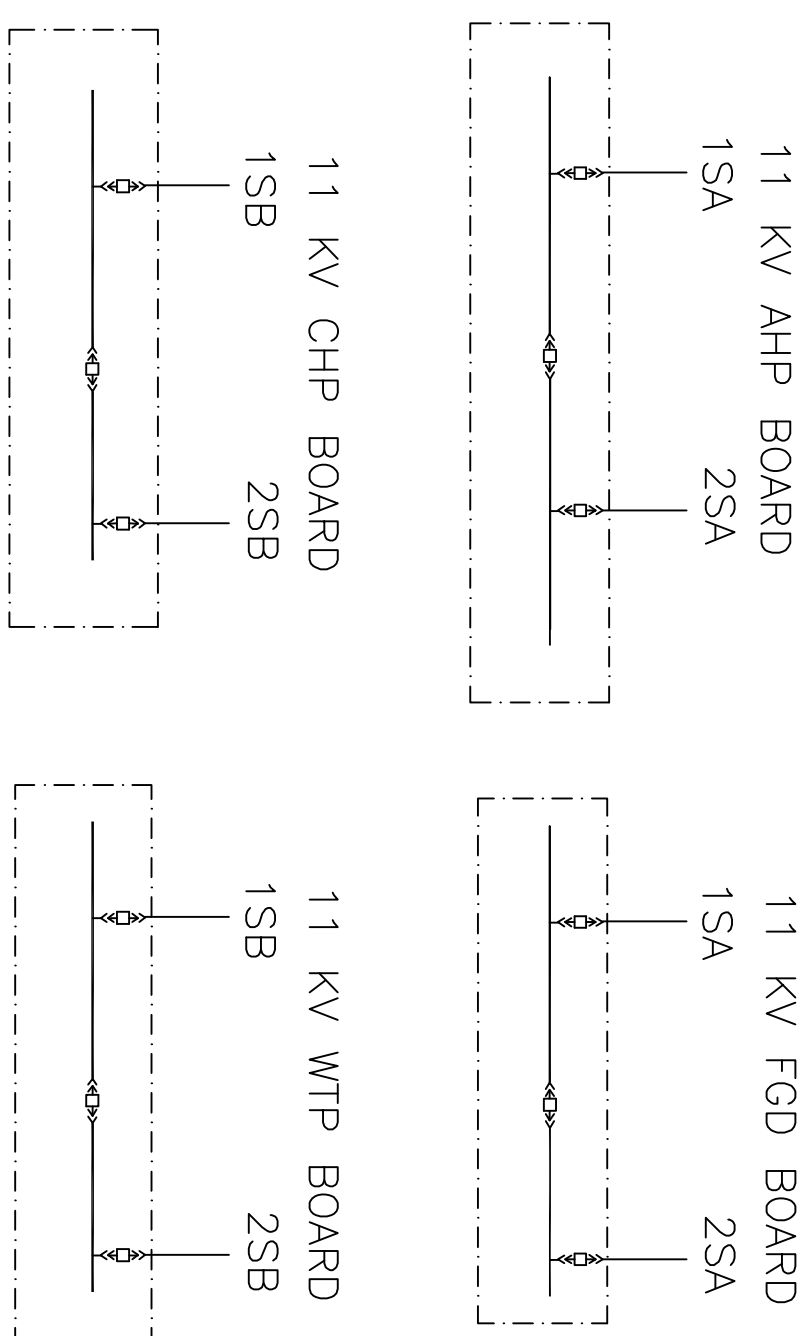
OVERHEAD CONNECTION TO SWITCHYARD



SS PACKAGE DC MOTORS TO BE DIRECTLY FED FROM MAIN DCDB

SS PACKAGE DC MOTORS TO BE DIRECTLY FED FROM MAIN DCDB

OUTDOOR TRANSFORMERS, HT CABLES FOR TIE/TRANSFORMER INCOMERS & OUTGONG FEEDERS, CIVIL WORKS OF THE SWITCHGEAR ROOMS FOR THE BELOW SUBSYSTEMS ARE EXCLUDED FROM BIDDERS SCOPE. SUPPLY ERECTION TESTING COMMISSIONING OF HT SWITCHGEAR/HT BUSDUCT AS REQUIRED FOR OWNERS SUBSYSTEM INDICATED BELOW IS IN BIDDERS SCOPE. FOR FEEDER DETAILS OF HT SWITCHGEAR REQUIRED FOR OWNERS USE REFER ANNEX-A TO SUBSECTION-IIB



ITEMS IN BIDDERS SCOPE

TENDER FOR SUPPLY, ERECTION, TESTING AND COMMISSIONING OF 420KV, 125MVAR BUS REACTOR AND 420KV, 800MVAR LINE REACTOR			
Sl. No.	Description of Work	Unit	Rate
1	Supply, Erection, Testing and Commissioning of 420KV, 125MVAR Bus Reactor	No.	
2	Supply, Erection, Testing and Commissioning of 420KV, 800MVAR Line Reactor	No.	
3	Supply, Erection, Testing and Commissioning of 11KV Switchgear	No.	
4	Supply, Erection, Testing and Commissioning of 11KV Busduct	Mtr.	
5	Supply, Erection, Testing and Commissioning of 11KV Cable	Mtr.	
6	Supply, Erection, Testing and Commissioning of 11KV Transformer	No.	
7	Supply, Erection, Testing and Commissioning of 11KV Reactor	No.	
8	Supply, Erection, Testing and Commissioning of 11KV Feeder	No.	
9	Supply, Erection, Testing and Commissioning of 11KV Standby	No.	
10	Supply, Erection, Testing and Commissioning of 11KV Emergency	No.	
11	Supply, Erection, Testing and Commissioning of 11KV Control	No.	
12	Supply, Erection, Testing and Commissioning of 11KV Protection	No.	
13	Supply, Erection, Testing and Commissioning of 11KV Metering	No.	
14	Supply, Erection, Testing and Commissioning of 11KV Instrumentation	No.	
15	Supply, Erection, Testing and Commissioning of 11KV Communication	No.	
16	Supply, Erection, Testing and Commissioning of 11KV Security	No.	
17	Supply, Erection, Testing and Commissioning of 11KV Maintenance	No.	
18	Supply, Erection, Testing and Commissioning of 11KV Training	No.	
19	Supply, Erection, Testing and Commissioning of 11KV Documentation	No.	
20	Supply, Erection, Testing and Commissioning of 11KV Other	No.	

FOR TENDER PURPOSE ONLY

TENDR INDIA LIMITED

REVISION 2.1

9910-000-000-1-000

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES 		
13.00.00	STEAM & WATER ANALYSIS SYSTEM (SWAS)		
13.01.00	The following shall be provided as a minimum meeting specification requirements stipulated under Sub- section SWAS, IIC-13, Part-B and item water system related analyzer system of Sub-section Measuring Instruments (primary and secondary), IIC-04, Part B, of Section-VI of Technical Specification.		
13.02.00	Sample piping from contractor's system and from Employer's systems, primary & secondary coolers, chiller etc., complete with sampling pumps, gauges, switches, valves etc.		
13.03.00	All analysers are to be supplied on as required basis subject to the minimum requirement as indicated in Contract Quantities for SWAS , Appendix-I to Part-A, Section-VI, "Contract Quantities other than DDCMIS Items, of technical specification to make the system complete in line with the intent of this specification. However any other analyzer, as required and recommended by Qualified Steam Turbine Generator Manufacturer (QSTGM) shall also be supplied by the contractor within the quoted contract price.		
13.04.00	Unit-wise SWAS panels viz. Primary Sample conditioning rack (at Boiler Floor and Deaerator Floor), Secondary Sample conditioning panel (Wet panel in SWAS Room) and analyzer panel (Dry panel in SWAS Room) complete with all accessories like valves, fittings, wiring etc.		
13.05.00	Information and alarm signals from SWAS system shall be hooked up to Unit DDCMIS for monitoring purpose. For display of information and alarm to local operator, a PC based station shall be provided in each of the SWAS rooms, which shall be connected with Unit TG DDCMIS through station LAN.		
13.06.00	All the chemicals and reagents required for initial commissioning and warranty period (18 months operation after successful commissioning) of SWAS is to be supplied in phased manner depending on shelf life, in addition to that indicated under mandatory spares. Contractor shall initially supply reagents for two months operation, further supply shall be based on commissioning schedule of Units and confirmation by site Engineer. Contractor to provide shelf life of all reagents during detail Engineering. All the reagents supplied to site shall have at least 90% of remaining useful life at the time of dispatch.		
13.07.00	Cooling water required for complete SWAS including primary coolers of boiler area & turbine area, secondary coolers, chiller etc. shall be provided from TG-ECW System. Contractor to provide all piping / fittings / valves etc. for cooling water supply for SWAS system. In case common chiller / Cooler is provided for two or more units, cooling water supply from ECW system of each Unit (through common header) shall be provided such that the SWAS system remains operable without loss of functions, even if ECW cooling water supply is available from any one of the Unit.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.: THDC/RKSH/CC-9915- 371	SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	Page 1 of 2

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	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.			
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 minimum. However, increase in panel size, if required, shall be taken care of by the			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371	SUB-SECTION - IIIC-13 SWAS	PAGE 1 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	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. 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		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371	SUB-SECTION - IIIC-13 SWAS	PAGE 2 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS	
2.08.00	(Section 5) to be provided in the sample lines at the primary cooler outlets. 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. (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.	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371	SUB-SECTION - IIIC-13 SWAS PAGE 3 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS	
2.10.00	(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. The Steam and Water Analysis system shall be provided with the sample shut off valves, blow down valves, solenoid actuated valves, pressure reducing 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 (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 Bidder shall submit the data sheet of these valves and these shall be subject to Employer's approval during detailed engineering stage.	
2.11.00	Gauges i) All temperature, pressure and level gauges are as per manufacturer's standard and proven practice. 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 $\pm 1\%$ of full scale or better.	
2.12.00	Switches 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 $\pm 2\%$. 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 $\pm 1.0\%$ of full scale range.	
2.13.00	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 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.	
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CLAUSE NO.	TECHNICAL REQUIREMENTS																																	
2.14.00	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.																																	
	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>Requirements</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><tr><td>Accuracy</td><td>≤ ± 1%</td><td>≤ ± 1%</td><td>≤ ± 5% of reading</td><td>≤ ± 5%</td><td>≤ 2% for range 0-50 NTU, ≤ 5% for range 50 – 200 NTU</td><td>≤ ± 1% of Reading</td></tr></table>							Minimum specifications of analysers							Requirements	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	Accuracy	≤ ± 1%	≤ ± 1%	≤ ± 5% of reading	≤ ± 5%	≤ 2% for range 0-50 NTU, ≤ 5% for range 50 – 200 NTU	≤ ± 1% of Reading
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - IIIC-13 SWAS		PAGE 5 OF 8																												

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	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 analysers continued						
	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	
	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			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - IIIC-13 SWAS		PAGE 6 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS					
3.02.00	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.				
		* The range selected for the analysers (of systems coming under this Package) shall be as per process requirement and same shall be vetted by OEM /QSTGM. Contractor to provide a document indicating selected ranges for each analyser (of systems coming under this Package).				
3.02.00	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 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.					
3.03.00	Contractor to provide piping arrangement in Wet Panel with remote operated 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 DM Make-up water pump. Necessary piping, valves, instruments for monitoring of DM water flow shall be in the scope of contractor.					
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - IIIC-13 SWAS	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
4.00.00 4.01.00 4.02.00 4.03.00 4.04.00 4.05.00 5.00.00	SAMPLE PIPING SYSTEM 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 for that sample line including grab sample and fouling factor requirement. 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. 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). 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. 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. 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. Contract quantities Refer Appendix- I to part A, Section VI of technical specifications.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO.: THDC/RKSH/CC-9915-371	SUB-SECTION - IIIC-13 SWAS	PAGE 8 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENT	Annexure IIIC-02K					
1.00.00	GENEREAL REQUIREMENTS FOR FIELDBUS INSTRUMENTS AND ACTUATORS This section provides the basic guidelines for the design and implementation of Fieldbus (Foundation Field Bus/ Profibus) based control system.						
1.01.00	The requirements given herein are minimum requirements to be considered by Contractor to ensure uniformity in basic design and shall not be considered as final requirements. The Fieldbus design shall be further validated by contractor and approved by Employer during detailed engineering and any variation/ changes required based on DDCMIS system requirements and actual field installation, operational philosophy etc. shall be considered by contractor without any implications.						
1.02.00	The fieldbus segment design shall be finalized and validated based on functional requirements as per: • Process requirements (P&IDs/ operational requirements). • Loop response time of different loops device communication time i.e. cycle time for fast and slow loops with scheduled and unscheduled organization as per project. • Area classification requirements (e.g. hazardous or safe). • Fieldbus devices specifications (maximum current drawn from bus, block execution speeds, power conditioner suitable for field barrier, etc.) • Length of segments. • Instrument location plans with elevation details. • Host-system documentation showing configuration rules or restrictions. • For Foundation Fieldbus & Profibus PA chicken foot/ branch/ or combination of both topology shall be provided. For Profibus DP, Bus/ Line topology in Redundant mode shall be provided. That is, for Profibus DP redundant cables connected to redundant ports of devices shall be provided. Suitable field bus segment design shall be considered keeping the safety & integrity of the system intact so that the cabling, marshalling, junction boxes and system performance shall be optimized. However, all such segment device allocation, topology shall be decided during detailed engineering. Any modification shall be carried out by contractor without price implication.						
1.03.00	Contractor to provide all standard functional blocks for all Foundation Fieldbus/ Profibus devices as per latest FF/ Profibus version and standard guidelines. Fieldbus components including power supply, terminators, isolators, etc. provided by Contractor shall comply to IEC 61158 and other standard Fieldbus guidelines.						
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>BID DOC. NO. : THDC/RKSH/CC-9915-371</td><td>TECHNICAL SPECIFICATIONS SECTION VI, PART-B</td><td>SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02K</td><td>PAGE 1 OF 4</td></tr></table>			KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	BID DOC. NO. : THDC/RKSH/CC-9915-371	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02K	PAGE 1 OF 4
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CLAUSE NO.	TECHNICAL REQUIREMENT				Annexure IIIC-02K
1.04.01	Redundant host/ master card and redundant power supply along with advance diagnostic module shall be provided. All required libraries to execute various tasks like data acquisition, control/protection etc. shall be provided.				
1.04.02	In fieldbus system following spare capacity in each FG shall be provided :				
	Sr. No (1)	Item (2)	Sub-Item (including description) (3)	Spare Capacity (4)	Spare Space (5)
	1	Foundation Fieldbus	Wired in space for mounting FF Host modules along with backplane / base / rack for future expansion.		20 % of Engineered quantity of Host modules
			Spare capacity in the redundant power supplies	20 % over and above Engineered capacity	-
			FF Segment Loading (Limited to a maximum of 10 nos. devices with a minimum voltage across each device of 11 V DC)	Out of each segment capacity calculated as per column (3), spare capacity of 2 nos. as a minimum for future expansion per segment shall be provided	-
			No of spare channels in the field mounted FF Junction boxes / distributors	Minimum 4 nos. in each JB / distributor	-
	2	Profibus DP	Wired in space for Redundant DP masters with required backplane / rack / base for expansion		Space for 1 set
			Capacity in redundant DP masters	20 % of Engineered DP segment capacity for DP devices	
	3	Profibus PA	Wired in space for mounting PA segment modules along with required backplane / rack / base for future expansion		20 % of supported PA segment modules by each DP/PA coupler/link
			Capacity in the redundant DP / PA coupler / link modules and corresponding DP masters for future expansion	20 % over and above engineered capacity	-
			Spare capacity in the redundant power supplies	20 % over and above designed rating	-
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CLAUSE NO.	TECHNICAL REQUIREMENT Annexure IIIC-02K				
			PA Segment Loading (Limited to a maximum of 10 nos. devices with a minimum voltage across each device of 11 V DC)	Out of each segment capacity calculated as per column (3), spare capacity of 2 nos. as a minimum for future expansion per segment shall be kept	-
			Channels in the field mounted Profibus PA Junction boxes / distributors	Minimum 4 nos. in each JB / distributor	-
	4	Controller(s) / system module(s)	These shall have spare hardware and software capacities, over and above engineered capacities, to cater to spare requirements defined above, for applicable items of S.No.1,2,3 along with their spare capacities defined in column (4) & (5)		
	1.04.03	The spare functional capacity of controller defined in Clause no 2.01.03 of Appendix-I to sub-section-IIIC-01 (Contract Quantities for DDCMIS Item), Part-A of Technical Specification will be applicable for both conventional and fieldbus based system (combined together).			
	1.05.00	The contractor shall present complete implementation scheme, including wiring scheme during detailed engineering stage for review and approval by Employer. Fieldbus cable (specifically used for Foundation Fieldbus/ Profibus PA and Profibus DP) shall be individually shielded twisted pair, with round steel wired amour (SWA) complying with IEC 61158, Type A. The cable construction shall meet EN 50288-7 standard for physical properties and the outer sheath shall be of PVC-TM53 as per EN 50290-2-22. Continuous operating temperature of Fieldbus cable shall be minimum 90 Deg C. The contractor shall furnish comparison of major electrical and physical properties of offered cables w.r.t specified standards to establish compliance of offered cables with this technical specification. For laying of fieldbus cables, cable trays envisaged for instrumentation cable with all the accessories shall be used by the contractor. Minimum 300 mm spacing to be kept between the fieldbus trays and other high voltage cables to avoid any interference. SS Junction boxes specially designed for fieldbus application shall be provided on as required basis. These SS JB's shall house field mounted fieldbus components like distributors, tee, etc. These SS JB's shall have suitable cover and gasket and shall have protection class of IP-66 or better. SS Cable glands and blind plugs shall be provided by the Contractor.			
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CLAUSE NO.	TECHNICAL REQUIREMENT	Annexure IIIC-02K
1.06.00	Comprehensive Fieldbus Maintenance and Diagnostic software shall be provided. This software shall be capable of collecting complete diagnostic information from fieldbus network and all fieldbus devices and presenting in user friendly interface for detailed diagnostic and troubleshooting of the system. It shall be possible to completely configure parameters of fieldbus network and fieldbus devices from centralized system through this software. This software shall have feature of providing data related to maintenance of fieldbus devices as available through fieldbus system. This system/ software shall have provision to get updated to latest version/ release of various fieldbus devices.	
1.07.00	During FAT suitable arrangement shall be made by Contractor to test Fieldbus modules including field devices as per approved FAT procedure.	
1.08.00	The contractor shall use fieldbus segment design tool / software to design complete network verifying various design parameters like device voltage, total cable length, spur length, system power requirements etc. the contractor shall provide device voltage calculations for all segments, based on calculation in software package. All these calculations shall be handed over during detailed engineering in electronic format in a way that Employer can thoroughly verify design basis/ calculations carried out by Contractor.	
1.09.00	Suitable short circuit protection, surge protection, grounding requirements shall be provided for all devices, so that fault in one device shall not impact the availability of other devices in the segment.	
1.10.00	All required diagnostic and configuration tools/ hand held devices shall be provided for configuration and troubleshooting of devices and network.	



8.2 Pile Construction

For construction of piles, properly mixed drilling mud should be used to control the caving of the borehole during drilling and concreting. The concrete used for the pile construction use of tremie concreting is recommended so as to ensure that the groundwater does not mix with the fresh concrete. It should be coherent, with a minimum cement content of 400 kg/m³. It should have a slump of about 150 to 180 mm.

The piling activity should ensure minimum disturbance to the soil around the pile shaft. The piling works should be executed by a specialist agency with sufficient experience in such works.

8.3 Pile Load Tests and Integrity Tests

We recommend that load tests be conducted on piles in order to confirm the static capacities and to ensure proper performance of the piles. A program of initial pile load tests and routine pile load tests should be drawn up and sufficient number of piles should be tested in accordance with IS: 2911 (Part-IV)- 2013 in order to ensure that the safe load on the pile is either equal to or greater than the working load on the piles.

All working piles should be subject to low-strain pile integrity testing (PIT)⁽⁵⁾ to determine if any unusual conditions, necking / bulging or voids in the shaft wall exist that could result in lower pile capacity.

In addition, we recommend that high strain dynamic pile load tests (HSDLT)⁽⁶⁾ (*preferably using 8-channel PDA equipment*) be carried out on some of the test piles/production piles to quickly assess the safe pile capacity and pile integrity. HSDLT can effectively supplement static load test. The test may be done on the existing piles to assess the cause of failure / distress as well on the new piles to assess the pile behavior.

HSDLT may result in substantial savings in the time and cost of foundation testing. The results of the dynamic load tests should be compared with static load test results for developing a site-specific correlation.

8.4 Chemical Attack

Results of chemical test on selected soil and water samples are tabulated below:

Location	Property	Soil	Groundwater
Khurja	pH Value	7.7-8.1	7.5-7.9
	Sulphates	0.10-0.13%	309-354 mg/litre
	Chlorides	0.03-0.09%	150-475mg/litre
	Carbonate	-	NIL
	Nitrates (mg/l)	-	3-41 mg/litre
	Turbidity	-	79-320 NTU
	Organic Matter	-	143-344 mg/l

⁽⁵⁾ Sanjay Gupta, Ravi Sundaram and Sorabh Gupta (2008), "**Pile Integrity Testing for Monitoring Pile Construction**", Proceedings, National Symposium on Geoenvironment, Geohazards, Geosynthetics and Ground Improvement- Experiences and Practices (4G) Indian Geotechnical Society (Delhi Chapter) pp 173-178.

⁽⁶⁾ ASTM D4945 - 08 Standard Test Method for High-Strain Dynamic Testing of Piles



IS: 456-2000 recommends that precautions should be taken against chemical degradation of concrete if:

- sulphates content of the soils exceeds 0.2 percent, or
- groundwater contains more than 300 mg /litre of sulphates (SO_3).

Comparing the test results with these specified limits for both locations, the sulphate content of the groundwater is marginally higher than the specified limit.

Therefore, strata at the site may be treated in **C** category for as described on IS: 456-2000. We recommend the following measures to limit the potential for long term chemical degradation of foundation concrete:

- (1) The minimum cement content in concrete for open foundations and pile caps should be 330 kg/m^3 . Piles should contain at least 400 kg/m^3 of cement.
- (2) Water cement ratio in foundation concrete should not exceed 0.50.
- (3) A clear concrete cover over the reinforcement steel of at least 50 mm should be provided for all foundations.
- (4) Concrete for the foundations should be densified adequately using a vibrator so as to form a dense impervious mass.

9.0 VARIABILITY IN SUBSURFACE CONDITIONS

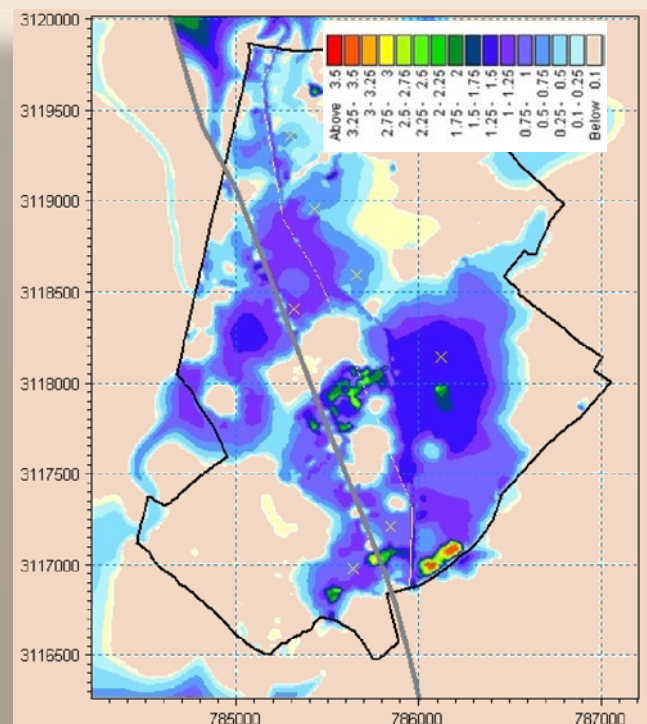
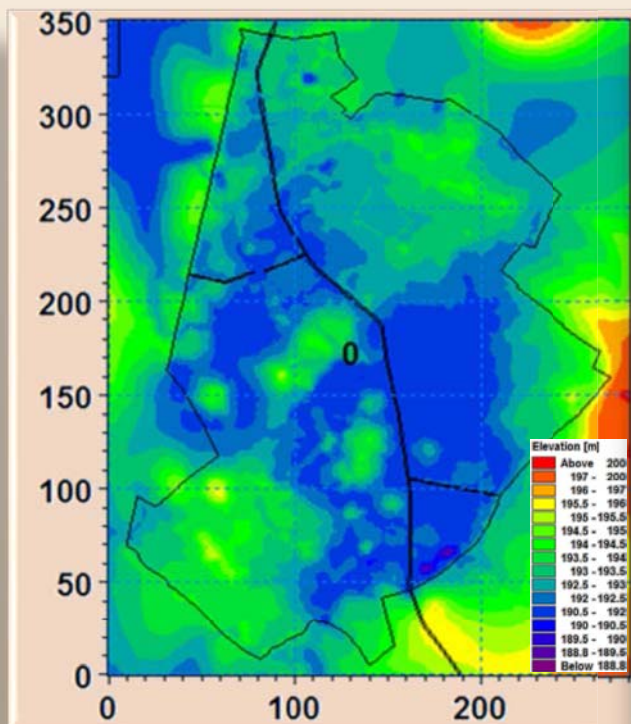
Subsurface conditions encountered during construction may vary somewhat from the conditions encountered during the site investigation. In case significant variations are encountered during construction, we request to be notified so that our engineers may review the recommendations in this report in light of these variations.

Project Report on Hydrographical Area Drainage Study for 2x660MW coal based Super Thermal Power Project Khurja

Sponsored by



THDC India Limited, Ghaziabad



आपो हिष्ठा मयोभुवः

NATIONAL INSTITUTE OF HYDROLOGY
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September, 2013

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Preface

THDC India Limited (formerly known as Tehri Hydro Development Corporation Ltd.), a Joint Venture of Govt. of India and Govt. of Uttar Pradesh was incorporated in July 1988 to develop, operate and maintain the 2400 MW Tehri Hydro Power Complex and other hydro projects. The object clause of the Company has been amended to incorporate development of Conventional/ Non-conventional/ Renewable sources of Energy and River Valley Projects. Towards diversification of the company into other energy areas. THDCIL has been entrusted with a coal based super thermal power station at Khurja in the state of Uttar Pradesh. The THDCIL approached NIH, Roorkee for carrying out the hydrographical area drainage study for the above mentioned coal based STPP at Khurja in distt. Bulandshahar (U.P). The THDCIL has offered NIH, Roorkee this study titled **“Hydrographical Area Drainage Study for 2x660MW coal based Super Thermal Power Project Khurja”** vide letter No Ref:/ 904 /THDC/KAU/T-D/231 dated 17.02.2012.

The study envisages identification of various flooding sources, estimation of maximum floods and their routing to the proposed plant site for estimating the maximum flood level. Further, this study also includes study of local drainage pattern and modification of existing Aligarh drain. The digital elevation model (DEM) has been prepared from the levels and contours extracted from topographical maps and the contour map provided by THDCIL. The catchment area has been delineated from this DEM. The rainfall data have been obtained from IMD. The L-moments based rainfall frequency analysis has been performed to estimate 1 day maximum rainfall for various return periods. The synthetic unit hydrographs are derived from catchment characteristics of the study area and the flood hydrographs for 25, 50 and 100 year return periods have been computed. Maximum flood has been estimated by the L-moments based rainfall frequency analysis and unit hydrograph approach. The flood routing study has been carried out using MIKE FLOOD package (a coupled 1D and 2-D flow analysis). The bathymetry of the flood plain around the plant site at 5 m grid size has been created from DEM. The spills from Aligarh drain and local rainfall (100 year return period) have been simulated in coupled MILE-11 and MIKE-21. The flooding due to 50, 25 and 10 year return period rainfall has been also considered and inundation depths as well as flood levels have been computed. The

maximum flood inundation area due to passing of design discharge in Aligarh drain and 100 year return period local rainfall is analysed for safe grade level estimation. The local and peripheral drains for the plant site are designed for 25 and 50 year return period rainfall.

The study has been carried out by Dr. Rakesh Kumar, Scientist F; Shri Jagadish Prasad Patra, Scientist B; Shri Pankaj Mani, Scientist D; Shri R.D. Singh, Director NIH Roorkee. Technical assistance has been provided by Shri T.R. Sapra, RA and Shri N.K. Bhatnagar, PRA of National Institute of Hydrology, Roorkee. It is expected that the study would fulfil the desired requirements of the THDCIL.

Raj Deva Singh
(R. D. Singh)

Director
National Institute of Hydrology, Roorkee

Acknowledgement

The study group at National Institute of Hydrology, Roorkee have made their best efforts in carrying out the study entitled **“Hydrographical Area Drainage Study for 2x660MW coal based Super Thermal Power Project Khurja”** sponsored by the THDC India Ltd., Kaushambi, Ghaziabad. I acknowledge sincere thanks to U.P. Irrigation Department for providing design discharge of Aligarh drain. I am also grateful to IMD for providing historical rainfall data for this study. I express gratefulness towards the officials of THDC India Ltd. for providing encouragement, help and support throughout the study. Specially, I am thankful to Shri R.K. Bhat, Addl. G.M. (Design-Thermal); Shri Praveen Saxena, Dy. G.M. (Design- Thermal); Shri R.S.Tomar Sr. Manager (Design-Thermal); Shri A.K. Mittal Sr. Manager (Design-Thermal); and Shri Ravindra Singh Dy Manager (Design-Thermal); for their constant supervision, coordination and support during field visits and for providing necessary information regarding the project.



(Dr. Rakesh Kumar)

Principal Investigator
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1 ABOUT THE PROJECT

THDC India Limited, a Schedule 'A' Mini Ratna Company has signed a memorandum of understanding with Govt. of U.P to set up a 1320 MW super thermal power plant at Khurja, Distt. Bulandshahar (U.P). For the preparation of Detailed Feasibility Report, apart from various other studies a study on Hydrographical Area Drainage system of the proposed area is essential. THDC India Limited, Ghaziabad requested National Institute of Hydrology, Roorkee to undertake the study to access natural drainage pattern and to decide upon the drainage system in and around the plant area and to access the measures to be adopted to address modification of existing natural drainage pattern. The original scopes of work are:

1. Study of existing natural drainage pattern/system with available information in the form of reports, literature, satellite imageries, etc. for proposed project and its adjoining areas. The study shall include review of topographical features of the proposed site for the Power Project and its surrounding area.
2. Review and analysis of rainfall information to arrive at design storm scenarios.
3. Review and analysis of relevant Survey of India Topographical Sheets, topographical survey and satellite imageries.
4. Estimation of flood hydrographs considering historical as well as design rainfall to suggest complete scheme for storm water drainage of project and its adjoining areas including diversion of existing nalas/streams, if any. In case short interval observed rainfall runoff data would be not available then the standard regional approaches will be used for design flood estimation.
5. Estimation and routing of design flood hydrograph through the drainage system of concerned catchments considering appropriate boundary conditions including pre-project scenario as well as post-project scenario for suggesting Safe Grade Elevation for the plant.
6. Suggesting final disposal point for the storm water & plant drainage.
7. Site visit for acquaintance of prevailing conditions and collection of available data at site.
8. Visit to THDC Office for discussions regarding the studies.

The scope of work as per the project proposal is given in Annexure-I.

2 DESCRIPTION OF STUDY AREA

2.1 General

The Plant site is located near village Dasehri, Dasehri Khrli, along NH 91 in Bulandshahr district of the state of Uttar Pradesh. The geographical extent of the proposed plant site is from 77°53.783'E to 77°55.373'E longitude and from 28°08.586'N to 28°10.417'N latitude approximately and covered in Survey of India toposheet no. 53H16 of 1:50000 scale. The project site is surrounded by villages namely: Dashara Khrli & Dashara in north; Rukanpur in south; Naiphal in east and Jawal in west. The majority area is uncultivated land and brick klin area. The geographical area of the plant site is about 5.3 km². The location of the site is given in Figure 2.1.

2.2 Topography and Drainage

The plant site is located in upper Indo- Ganga plains. The Aligarh drain and NH-91 passes through the proposed plant area. The general topography of the area is and elevation in the proposed plant area varies from 189.5 m to 196 m. The general land slope is towards South. The existing drainage in and around the site is given in Figure 2.2. The Aligarh drain is the main drain passing through the site. As per the information available the Aligarh drain starts from Agaura branch cut. Total length of the Aligarh drain is 121.204 km and the length of the drain up to entry to plant boundary is about 6.5 m. The Malgosa branch cut and Nagla shaikhu drain joins Aligarh drain in its upstream of plant boundary. The Ghatal branch cut joins to Aligarh drain inside plant boundary. Further one small drain after crossing the highway and another drain from other side of Aligarh drain joins to Aligarh drain inside plant boundary area. Apart from these there are two culverts in highway, to drain the runoff generated from the west side of highway area and join to Aligarh drain.

2.3 Climate

Bulandshahr is located in the Meerut division of Uttar Pradesh, between the Ganga and Yamuna rivers. The climate of Bulandshahr is extreme and tropical. The district average temperature in summer and winter season is 33.52°C and 14.33°C respectively. The summers are extremely hot and the maximum temperature goes as high as 45° C, while the winters remain cold, with temperature dipping to 2° C.

2.4 Rainfall

The normal annual rainfall of the district is about 673.5 mm (Department of Agriculture & Cooperation, 2012). However in last five year during monsoon season deficit from normal has been observed (IMD, 2012).

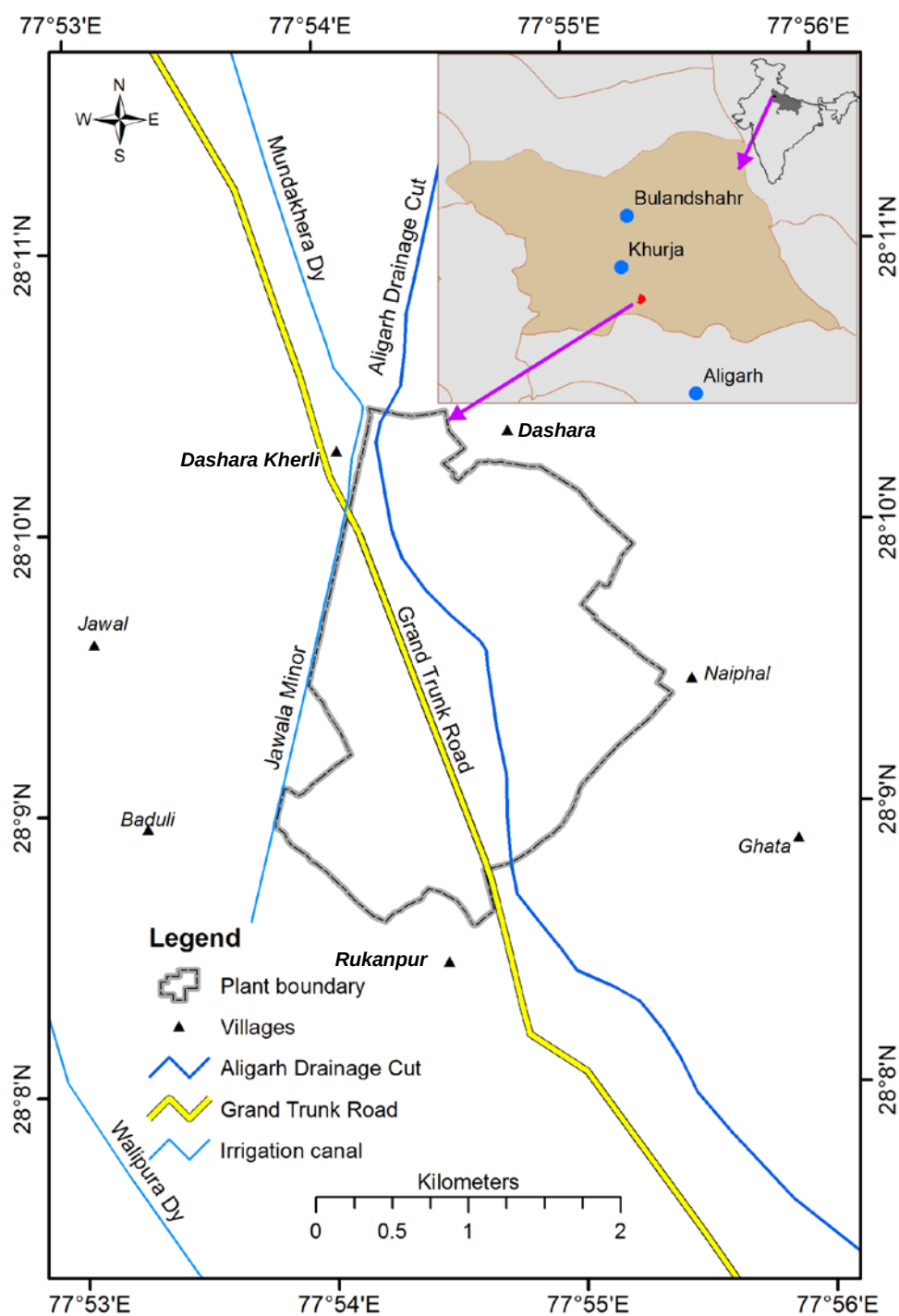


Figure 2.1: Index map of the study Area

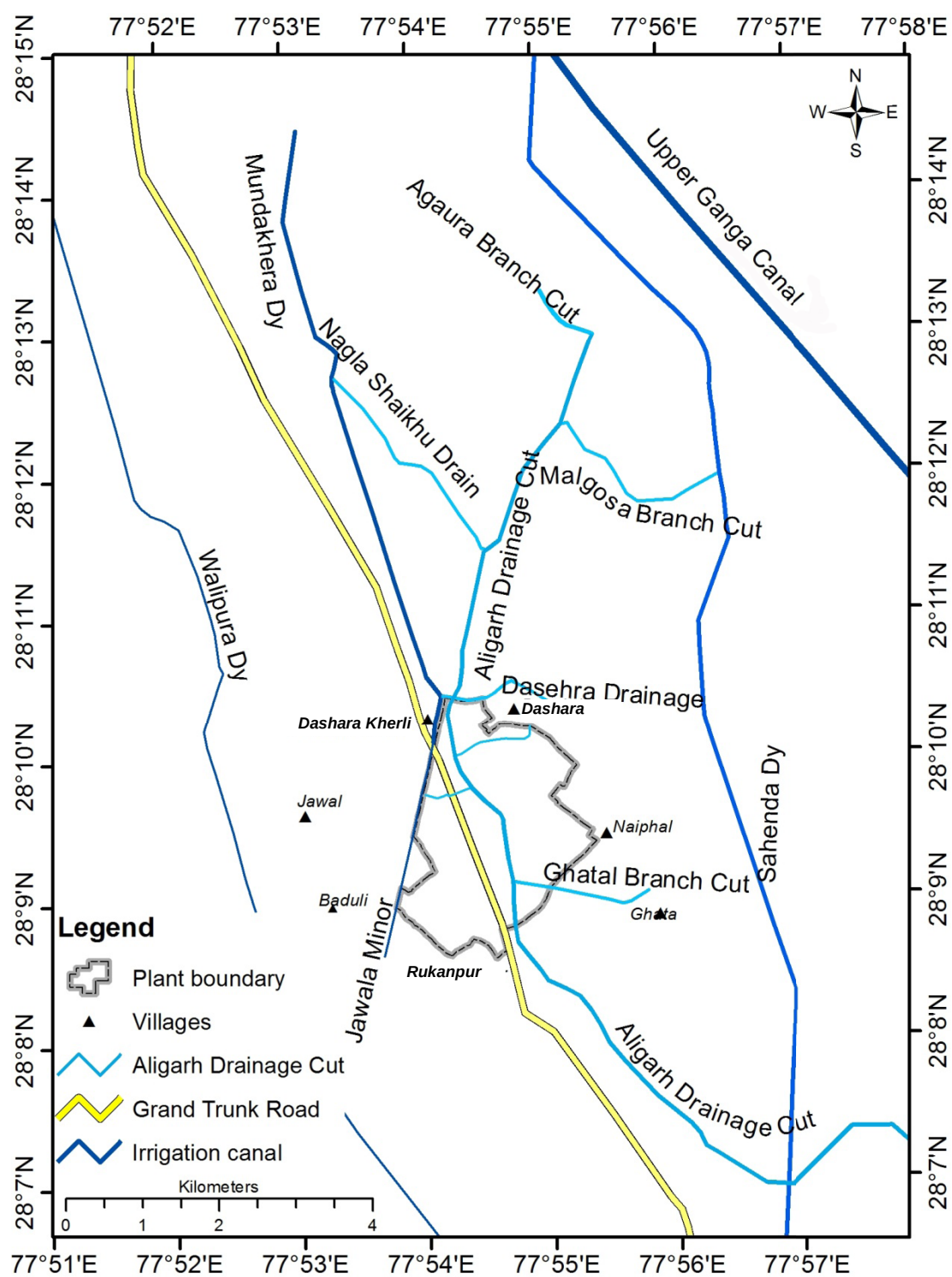


Figure 2.2: Drainage pattern around the Plant area

3 DATA AVAILABILITY

This chapter describes data availability for design flood estimation using the deterministic approach based on unit hydrograph method and L-moments based rainfall and flood frequency analysis.

3.1 Data Availability for Unit Hydrograph Analysis

The observed data for application of the unit hydrograph approach were not available. Hence, in this study the synthetic unit hydrograph was derived using the Flood Estimation Report for the Upper Indo-Ganga plains Subzone-1(e) (CWC, 1984). The CWC report is based on the detailed synthetic unit hydrograph studies carried out by utilizing the data of 23 representative catchments. Total two available Survey of India toposheets of 1:50,000 scales (Figure 3.1) were used with surveyed contour map and SRTM DEM for deriving catchment characteristics.

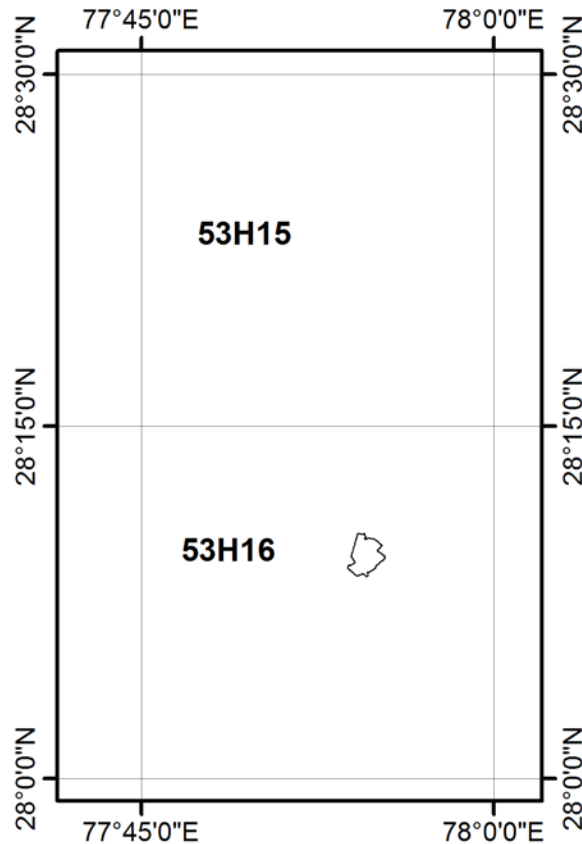


Figure 3.1: Layout of toposheets used in this study.

The design storm depth and its time distribution has been adopted from flood estimation report of the CWC (1984) Upper Indo-Ganga plains Subzone-1(e).

3.2 Data Availability for Rainfall frequency Analysis

Daily rainfalls for three rain gauge stations namely: Aligarh, Bulandshahr and Khurja (Figure 3.2) were obtained from IMD. The Thiessen Polygon (Figure 3.2) were created using “Create Thiessen Polygons” tool in ArcToolbox of ArcGIS 10. The details of rainfall data available with missing value are given in Table 3.1.

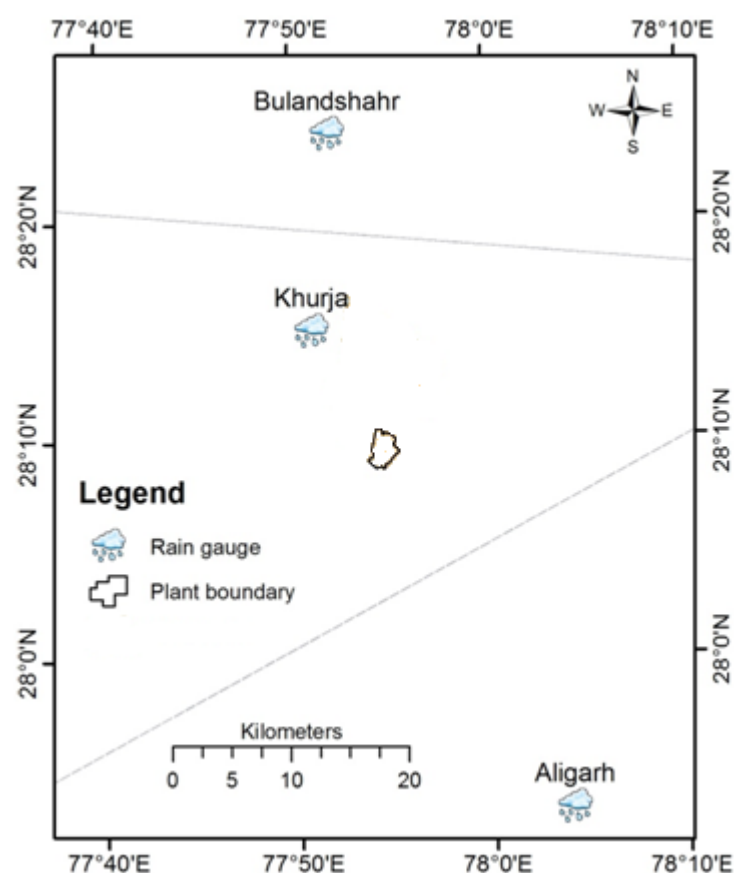


Figure 3.2: Rain-gauge stations with Thiessen Polygon

Table 3.1 Details of rainfall data availability

Rainfall Station	Type of data	Period of availability	Missing value in year	Length of data available
Aligarh	Daily	1951 to 2006	1993,1998	54
Bulandshahr	Daily	1970 to 1982	Nil	13
Khurja	Daily	1951 to 2009	1973,1974,1977,1978,1983, 1984	53

3.3 Topographic and Drainage Network

The topographic survey in the proposed plant area was carried out by THDC and the contours were provided for this study (Figure 3.3). Further, cross-section of Aligarh drain and other drains were also measured during survey. The bathymetry is prepared from SRTM DEM, contour and spot height of SOI toposheet and surveyed contour elevation.

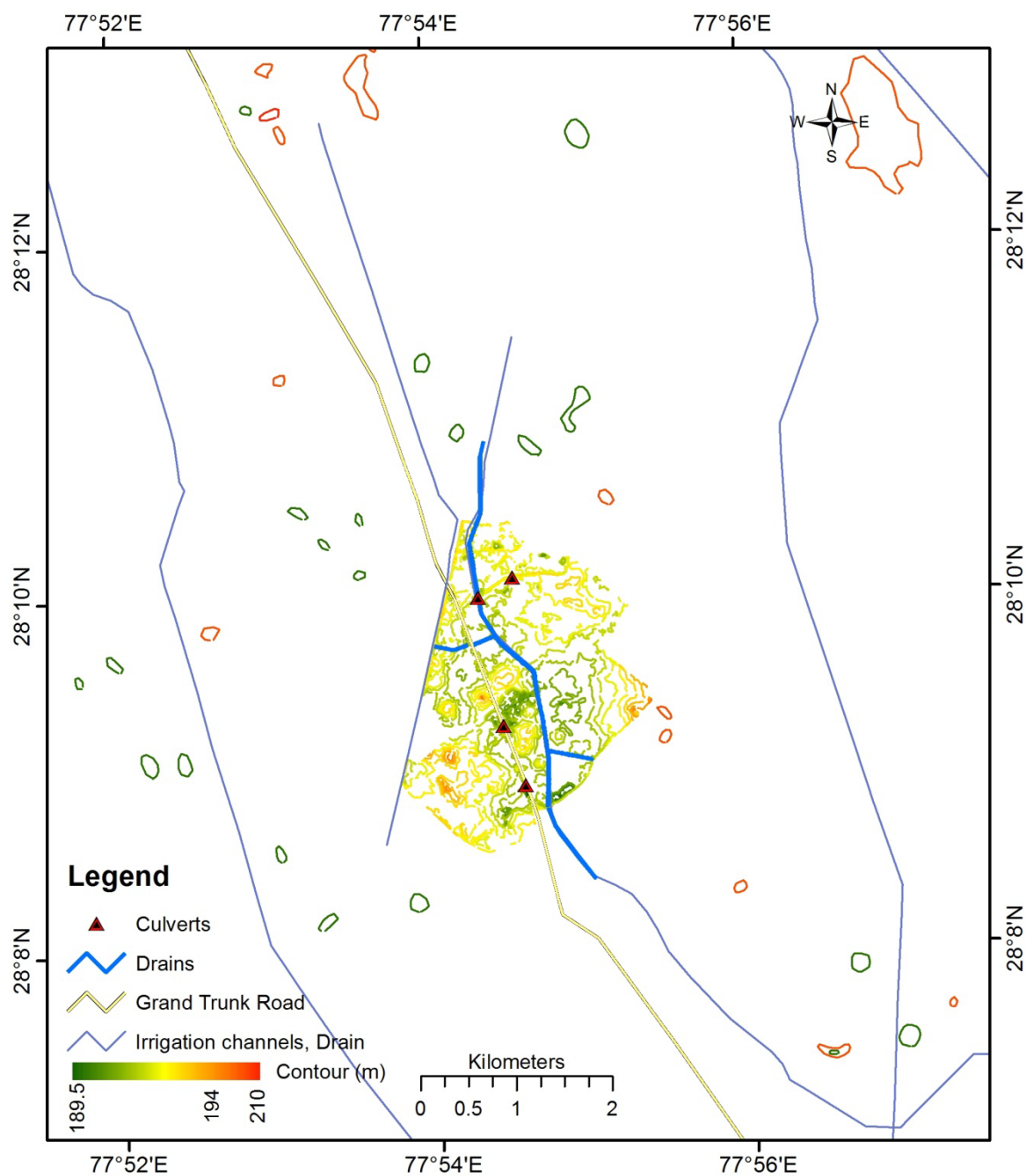


Figure 3.3 Topographical features of study area

4 METHODOLOGY

The methodology used for estimation of design flood using the synthetic unit hydrograph approach and methodologies for analyzing flood inundation this flood described as follows.

4.1 Estimation of Rainfalls of Various Return Periods Using L-Moments Based Rainfall Frequency Analysis

The following aspects of methodology of L-moments based regional frequency relationship for gauged catchments as well as ungauged catchments are discussed as follows.

- (i) Probability weighted moments (PWMs) and L-moments,
- (ii) Data screening and missing value correction,
- (iii) Test of regional homogeneity,
- (iv) Frequency distributions used,
- (v) Goodness of fit measures, and
- (vi) Development of relationship between mean annual peak flood and catchment area.

In this study at-site rainfall frequency analysis and regional frequency analysis (Kumar and Chatterjee, 2005; Kumar et al., 2011) has been applied as discussed in Chapter 5.1.

4.1.1 Probability weighted moments (PWMs) and L-moments

L-moments of a random variable were first introduced by Hosking (1990). Hosking and Wallis (1997) state that L-moments are an alternative system of describing the shapes of probability distributions. Historically they arose as modifications of the probability weighted moments' (PWMs) of Greenwood et al. (1979).

4.1.1.1 Probability weighted moments (PWMs)

Probability weighted moments are defined by Greenwood et al. (1979) as:

$$M_{i,j,k} = \int_0^1 x(F)^i (F)^j (1-F)^k dF \quad (1)$$

where, $F = F(x) = \int_{-x}^x f(x) dx$ is the cumulative density function and $x(F)$ is the inverse of it; i, j, k are the real numbers. The particularly useful special cases of the PWMs α_k and β_j are:

$$\alpha_k = M_{1,0,k} = \int_0^1 x(F) (1-F)^k dF \quad (2)$$

$$\beta_j = M_{1,j,0} = \int_0^1 x(F) (F)^j dF \quad (3)$$

These equations are in contrast with the definition of the ordinary conventional moments, which may be written as:

$$E(X^r) = \int \{x(F)\}^r dF \quad (4)$$

The conventional moments or “*product moments*” involve higher powers of the quantile function $x(F)$; whereas, PWMs involve successively higher powers of non-exceedance probability (F) or exceedance probability ($1-F$) and may be regarded as integrals of $x(F)$ weighted by the polynomials F^r or $(1-F)^r$. As the quantile function $x(F)$ is weighted by the probability F or $(1-F)$, hence these are named as probability weighted moments.

However, PWMs are difficult to interpret as measures of scale and shape of a probability distribution. This information is carried in certain linear combinations of the PWMs. These linear combinations arise naturally from integrals of $x(F)$ weighted not by polynomials F^r or $(1-f)^r$ but by a set of orthogonal polynomials (Hosking and Wallis, 1997).

4.1.1.2 L-moments

Hosking (1990) defined L-moments as linear combination of probability weighted moments. In general, in terms of α_k and β_j , L-moments are defined as:

$$\lambda_{r+1} = (-1)^r \sum_{k=0}^r p_{r,k}^* \alpha_k = \sum_{k=0}^r p_{r,k}^* \beta_k \quad (5)$$

where, $p_{r,k}^r$ is an orthogonal polynomial (shifted Legendre polynomial) expressed as:

$$p_{r,k}^* = (-1)^{r-k} {}^r C_k {}^{r+k} C_k = \frac{(-1)^{r-k} (r+k)!}{(k!)^2 (r-k)!} \quad (6)$$

L-moments are easily computed in terms of probability weighted moments (PWMs) as given below.

$$\lambda_1 = \alpha_0 = \beta_0 \quad (7)$$

$$\lambda_2 = \alpha_0 - 2\alpha_1 = 2\beta_1 - \beta_0 \quad (8)$$

$$\lambda_3 = \alpha_0 - 6\alpha_1 + 6\alpha_2 = 6\beta_2 - 6\beta_1 + \beta_0 \quad (9)$$

$$\lambda_4 = \alpha_0 - 12\alpha_1 + 30\alpha_2 - 20\alpha_3 = 20\beta_3 - 30\beta_2 + 12\beta_1 + \beta_0 \quad (10)$$

The procedure based on PWMs and L-moments are equivalent. However, L-moments are more convenient, as these are directly interpretable as measures of the scale and shape of probability distributions. Clearly λ_1 , the mean, is a measure of location, λ_2 is a measure of scale or dispersion of random variable. It is often convenient to standardise the higher moments so that they are independent of units of measurement.

$$\tau_r = \frac{\lambda_r}{\lambda_2} \quad \text{for } r = 3, 4 \quad (11)$$

Analogous to conventional moment ratios, such as coefficient of skewness τ_3 is the L-skewness and reflects the degree of symmetry of a sample. Similarly τ_4 is a measure of peakedness and is referred to as L-kurtosis. These are defined as:

$$\text{L-coefficient of variation (L-CV), } (\tau) = \lambda_2 / \lambda_1$$

$$\text{L-coefficient of skewness, L-skewness } (\tau_3) = \lambda_3 / \lambda_2$$

$$\text{L-coefficient of kurtosis, L-kurtosis } (\tau_4) = \lambda_4 / \lambda_2$$

Symmetric distributions have $\tau_3 = 0$ and its values lie between -1 and +1. Although the theory and application of L-moments is parallel to that of conventional moments, L-moments have several important advantages. Since sample estimators of L-moments are always linear combination of ranked observations, they are subject to less bias than ordinary product moments. This is because ordinary product moments require squaring, cubing and so on of observations. This causes them to give greater weight to the observations far from the mean, resulting in substantial bias and variance.

Zafirakou-Koulouris et al. (1998) mention that like ordinary product moments, L-moments summarise the characteristics or shapes of theoretical probability distributions and observed samples. Both moment types offer measures of distributional location (mean), scale (variance), skewness (shape), and kurtosis (peakedness). The authors further mention that L-moments offer significant advantages over ordinary product moments, especially for environmental data sets, because of the following:

- i. L-moment ratio estimators of location, scale and shape are nearly unbiased, regardless of the probability distribution from which the observations arise (Hosking, 1990).

- ii. L-moment ratio estimators such as $L-C_v$, L-skewness, and L-kurtosis can exhibit lower bias than conventional product moment ratios, especially for highly skewed samples.
- iii. The L-moment ratio estimators of $L-C_v$ and L-skewness do not have bounds which depend on sample size as do the ordinary product moment ratio estimators of C_v and skewness.
- iv. L-moment estimators are linear combinations of the observations and thus are less sensitive to the largest observations in a sample than product moment estimators, which square or cube the observations.
- v. L-moment ratio diagrams are particularly good at identifying the distributional properties of highly skewed data, whereas ordinary product moment diagrams are almost useless for this task (Vogel and Fennessey, 1993).

4.1.2 Data screening and missing value correction

In flood frequency analysis, the data collected at various sites should be true representative of the annual maximum peak flood measured and must be drawn from the same frequency distribution. The first step in flood frequency analysis is to verify that the data are appropriate for the analysis. The preliminary screening of the data must be carried out to ensure that the above requirements are satisfied. Errors in data may occur due to incorrect recording or transcription of the data values or due to shifting of the gauging site to a different location as well as due to changes in the measuring practices or as a result of water resources development activities. Tests for outliers and trends are well established in the statistical literature (e.g., Barnett and Lewis, 1994; W.R.C., 1981; Kendall, 1975). For comparison of data observed from different sites, some techniques such as double mass plots or quantile-quantile plots are commonly used.

Hosking and Wallis (1997) mention that in the context of regional frequency analysis using L-moments, useful information can be obtained by comparing the sample L-moment ratios for different sites, incorrect data values, outliers, trends and shifts in the mean of a sample can all be related to L-moments of the sample. A convenient amalgamation of the L-moment ratios into a single statistic, a measure of discordancy between L-moment ratios of a site and the average L-moment ratios of a group of similar sites, has been termed as “discordancy measure”, D_i .

4.1.2.1 Discordancy measure

The aim of the discordancy measure is to identify those sites from a group of given sites that are grossly discordant with the group as a whole. Discordancy is measured in terms of

the L-moments of the data of the various sites as defined below (Hosking and Wallis, 1997). Suppose that there are N sites in the group. Let $u_i = [t^{(i)} \ t_3^{(i)} \ t_4^{(i)}]^T$ be a vector containing the t , t_3 and t_4 values for site i : T denotes transposition of a vector or matrix. Let

$$\bar{u} = N^{-1} \sum_{i=1}^N u_i \quad (12)$$

be (unweighted) group average. The matrix of sums of squares and cross products is defined as:

$$A = \sum_{i=1}^N (u_i - \bar{u})(u_i - \bar{u})^T \quad (13)$$

The discordancy measure for site i is defined as:

$$D_i = \frac{1}{3} N (u_i - \bar{u})^T A^{-1} (u_i - \bar{u}) \quad (14)$$

The site i is declared to be discordant if D_i is larger than the critical value of the discordancy statistic D_i given in Table 4.1.

Table 4.1 Critical values of discordancy statistic, D_i
(Adapted from Hosking and Wallis, 1997)

No. of sites in region	Critical value	No. of sites in region	Critical value
5	1.333	10	2.491
6	1.648	11	2.632
7	1.917	12	2.757
8	2.140	13	2.869
9	2.329	14	2.971
		≥ 15	3

For a discordancy test with significance level α an approximate critical value of $\max_i D_i$ is $(N-1)Z/(N-4+3Z)$, where Z is the upper $100\alpha/N$ percentage point of an F distribution with 3 and $N-4$ degrees of freedom. This critical value is a function of α and N , where $\alpha = 0.10$. D_i is likely to be useful only for regions with $N \geq 7$.

4.1.3 Test of regional homogeneity

A test statistic H , termed as heterogeneity measure has been proposed by Hosking and Wallis (1993). It compares the inter-site variations in sample L-moments for the group of sites with what would be expected of a homogeneous region. The inter-site variation of L-moment ratio is measured as the standard deviation (V) of the at-site LCV's weighted proportionally to the record length at each site. To establish what would be expected of a homogeneous region, simulations are used. A number of, say 500 data regions are generated based on the regional weighted average statistics using a four parameter distribution e.g. Kappa or Wakeby distribution. The inter-site variation of each generated region is obtained and the mean (μ_v) and standard deviation (σ_v) of the computed inter-site variation is obtained.

Let the proposed region has N sites with site i having record length n_i and sample L-moment ratios $t^{(i)}$, $t_3^{(i)}$, and $t_4^{(i)}$. The regional average L-CV, L-Skewness and L-Kurtosis weighted proportionally to the sites' record length for example, t^R mentioned below. The various steps involved in computation of heterogeneity measure (H) are mentioned below.

- (i) Compute the weighted regional average L moment ratios

$$t^R = \frac{\sum_{i=1}^{N_s} n_i t^{(i)}}{\sum_{i=1}^{N_s} n_i} \quad (15)$$

The value of t_3^R and t_4^R can also be computed similarly by replacing $t^{(i)}$ by $t_3^{(i)}$, and $t_4^{(i)}$.

- (ii) Compute the weighted standard deviation of at site LCV's ($t^{(i)}$)

$$V = \left[\frac{\sum_{i=1}^N n_i (t^{(i)} - t^R)^2}{\sum_{i=1}^N n_i} \right]^{1/2} \quad (16)$$

- (iii) Fit a general 4-parameter distribution (Kappa or 4 parameter Wakeby etc.) to the regional average L-moment ratios, t^R , t_3^R and t_4^R .
- (iv) Simulate a large number of regions say 500 having same record lengths as the observed data of the proposed region.

- (v) Repeat steps 1 and 2 for each of the 500 simulated regions and calculate the weighted standard deviations for each simulated region and take it as $v_1, v_2, v_3, \dots, v_{500}$.
- (vi) Compute the mean (μ_v) and standard deviation (σ_v) of the values obtained in step (v).
- (vii) Compute the Heterogeneity measure H as given below.

$$H = \frac{V - \mu_v}{\sigma_v} \quad (17)$$

The criteria established by Hosking and Wallis (1993) for assessing heterogeneity of a region is as follows.

- If $H < 1$ Region is acceptably homogeneous.
- If $1 \leq H < 2$ Region is possibly heterogeneous.
- If $H \geq 2$ Region is definitely heterogeneous.

4.1.4 Frequency distributions used

The following twelve frequency distributions have been used in this study.

- i. Extreme value (EV1)/ Gumbel distribution
- ii. General extreme value (GEV)
- iii. Logistic (LOS)
- iv. Generalized logistic (GLO)
- v. Normal (NOR)
- vi. Generalized Pareto (GPA)
- vii. Generalized normal (GNO)
- viii. Uniform (UNF)
- ix. Pearson Type-III (PT3)
- x. Kappa (KAP) and
- xi. Wakeby (WAK)
- xii. Exponential (EXP)

The details about these distributions and relationships among parameters of these distributions and L-moments are available in literature (e.g. Hosking and Wallis, 1997) and the same are summarized below.

4.1.4.1 Extreme value type-I distribution (EV1)

Extreme Value Type-I distribution (EV1) is a two parameter distribution and it is popularly known as Gumbel distribution. The quantile function or the inverse form of the distribution is expressed as:

$$x(F) = u - \alpha \ln(-\ln F) \quad (18)$$

Where, u and α are the location and scale parameters respectively, F is the non-exceedence probability viz. $(1-1/T)$ and T is return period in years.

4.1.4.2 General extreme value distribution (GEV)

General Extreme Value distribution (GEV) is a generalized three parameter extreme value distribution. Its theory and practical applications are reviewed in the Flood Studies Report (NERC,1975). The quantile function or the inverse form of the distribution is expressed as:

$$x(F) = u + \alpha \{1 - (-\ln F)^k\} / k; \quad k \neq 0 \quad (19)$$

$$x(F) = u - \alpha \ln(-\ln F) \quad k = 0 \quad (20)$$

Where, u , α and k are location, scale and shape parameters of GEV distribution respectively. EV1 distribution is the special case of the GEV distribution, when $k = 0$.

4.1.4.3 Logistic distribution (LOS)

Inverse form of the Logistic distribution (LOS) is expressed as:

$$x(F) = u - \alpha \ln \{(1-F) / F\} \quad (21)$$

Where, u and α are location and scale parameters respectively.

4.1.4.4 Generalized logistic distribution (GLO)

Inverse form of the Generalized Logistic distribution (GLO) is expressed as:

$$x(F) = u + \alpha [1 - \{(1-F) / F\}^k] / k; \quad k \neq 0 \quad (22)$$

$$x(F) = u - \alpha \ln \{(1-F)/F\}; \quad k = 0 \quad (23)$$

Where, u , α and k are location, scale and shape parameters respectively. Logistic distribution is the special case of the Generalized Logistic distribution, when $k = 0$.

4.1.4.5 Generalized Pareto distribution (GPA)

Inverse form of the Generalized Pareto distribution (GPA) is expressed as:

$$x(F) = u + \alpha \{1 - (1-F)^k\} / k; \quad k \neq 0 \quad (24)$$

$$x(F) = u - \alpha \ln(1-F) \quad k = 0 \quad (25)$$

where, u , α and k are location, scale and shape parameters respectively. Exponential distribution is special case of Generalized Pareto distribution, when $k = 0$.

4.1.4.6 Generalized normal distribution (GNO)

The cumulative density function of the three parameter Generalized normal distribution (GNO) is given below.

$$F(x) = \phi \left[-k^{-1} \log \{1 - k(x - \xi) / \alpha\} \right] \quad (26)$$

where, ξ , α and k are its location, scale and shape parameters respectively. When $k = 0$, it becomes normal distribution with parameters ξ and α . This distribution has no explicit analytical inverse form.

4.1.4.7 Pearson Type-III distribution (PT-III)

The inverse form of the Pearson type-III distribution is not explicitly defined. Hosking and Wallis (1997) mention that the Pearson type-III distribution combines Gamma distributions (which have positive skewness), reflected Gamma distributions (which have negative skewness) and the normal distribution (which has zero skewness). The authors parameterize the Pearson type-III distribution by its first three conventional moments viz. mean μ , the standard deviation σ , and the skewness γ . The relationship between these parameters and those of the Gamma distribution is as follows. Let X be a random variable with a Pearson type-III distribution with parameters μ , σ and γ . If $\gamma > 0$, then $X - \mu + 2\sigma/\gamma$ has a Gamma distribution with parameters $\alpha = 4/\gamma^2$, $\beta = \sigma\gamma/2$. If $\gamma = 0$, then X has normal distribution with mean μ and standard deviation σ . If $\gamma < 0$, then $-X + \mu - 2\sigma/\gamma$ has a Gamma distribution with parameters $\alpha = 4/\gamma^2$, $\beta = |\sigma\gamma/2|$.

If $\gamma \neq 0$, let $\alpha = 4/\gamma^2$, $\beta = |\sigma \gamma/2|$, and $\xi = \mu - 2\sigma/\gamma$ and $\Gamma(\cdot)$ is Gamma function. If $\gamma > 0$, then the range of x is $\xi \leq x < \infty$ and the cumulative distribution function is:

$$F(x) = G\left(\alpha, \frac{x-\xi}{\beta}\right) / \Gamma(\alpha) \quad (27)$$

If $\gamma < 0$, then the range of x is $-\infty < x \leq \xi$ and the cumulative distribution function is:

$$F(x) = 1 - G\left(\alpha, \frac{\xi-x}{\beta}\right) / \Gamma(\alpha) \quad (28)$$

4.1.4.8 Kappa distribution (KAP)

The kappa distribution is a four parameter distribution that includes as special cases the Generalized logistic (GLO), Generalized extreme value (GEV) and Generalized Pareto distribution (GPA).

$$x(F) = \xi + \alpha \left[1 - \left\{ (1-F)^h / h \right\}^k \right] / k \quad (29)$$

where, ξ is the location parameter, α is the scale parameter.

When $h = -1$, it becomes Generalized logistic (GLO) distribution; $h = 0$ is the Generalized extreme value (GEV) distribution; and $h = 0$ is the Generalized Pareto (GPA) distribution. It is useful as a general distribution with which to compare the fit of two and three parameter distributions and for use in simulating artificial data in order to assess the accuracy of statistical methods (Hosking and Wallis, 1997).

4.1.4.9 Wakeby distribution (WAK)

Inverse form of the five parameter Wakeby (WAK) distribution is expressed as:

$$x(F) = \xi + \frac{\alpha}{\beta} \left\{ 1 - (1-F)^\beta \right\} - \frac{\gamma}{\delta} \left\{ 1 - (1-F) - \delta \right\} \quad (30)$$

where, ξ , α , β , γ , and δ are the parameters of the Wakeby distribution.

4.1.5 Goodness of fit measures

In a realistically homogeneous region, all the sites follow the same frequency distribution. But as some heterogeneity is usually present in a region so no single distribution is expected to provide a true fit for all the sites of the region. In regional flood frequency analysis the aim is to identify a distribution which will yield reasonably accurate quantile estimates for each site of the homogeneous region. Assessment of validity of the candidate distribution may be made on the basis of how well the distribution fits the observed data. The goodness of fit measure assesses the relative performance of various fitted distributions and help in identifying the robust viz. most appropriate distribution for the region. A number of methods are available for testing goodness of fit of the proposed flood frequency analysis models. These include Chi-square test, Kolmogorov-Smirnov test, descriptive ability tests and the predictive ability tests. Cunnane (1989) has brought out a comprehensive description of the descriptive ability tests and the predictive ability tests. Apart from the aforementioned tests the recently introduced L-moment ratio diagram based on the approximations given by Hosking (1991) and the goodness of fit or behaviour analysis measure for a frequency distribution given by statistic Z_i^{dist} described below, are also used to identify the suitable frequency distribution.

4.1.5.1 L-moment ratio diagram

The L-moment statistics of a sample reflect every information about the data and provide a satisfactory approximation to the distribution of sample values. The L-moment ratio diagram can therefore be used to identify the underlying frequency distribution. The average L-moment statistics of the region is plotted on the L-moment ratio diagram and the distribution nearest to the plotted point is identified as the underlying frequency distribution. One big advantage of L-moment ratio diagram is that one can compare fit of several distributions using a single graphical instrument (Vogel and Fennessey, 1993).

4.1.5.2 Z_i^{dist} Statistic as a goodness-of-fit measure

In this method also the objective is to identify a distribution which fits the observed data acceptably closely. The goodness of fit is judged by how well the L-Skewness and L-Kurtosis of the fitted distribution match the regional average L-Skewness and L-Kurtosis of the observed data. The goodness-of-fit measure for a distribution is given by statistic Z_i^{dist} .

$$Z_i^{\text{dist}} = \frac{(\bar{\tau}_i^R - \tau_i^{\text{dist}})}{\sigma_i^{\text{dist}}} \quad (31)$$

where $\bar{\tau}_i^R$ - weighted regional average of L-moment statistic i , τ_i^{dist} and σ_i^{dist} are the simulated regional average and standard deviation of L-moment statistics i for a given distribution.

The distribution giving the minimum $|Z^{\text{dist}}|$ value is considered as the best fit distribution. When all the three L-moment ratios are considered in the goodness-of-fit test, the distribution that gives the best overall fit when all the three statistics are considered together is selected as the underlying regional frequency distribution. According to Hosking (1993), distribution is considered to give good fit if $|Z^{\text{dist}}|$ is sufficiently close to zero, a reasonable criteria being $|Z^{\text{dist}}| \leq 1.64$.

Let the homogeneous region has N_s sites with site i having record length n_i and sample L-moment ratios t_i , t_{3i} & t_{4i} . Steps involved in computation of statistic Z_i^{dist} are:

- i. Compute the weighted regional average L-moment ratios.

$$t^R = \frac{\sum_{i=1}^{N_s} n_i t_i}{\sum_{i=1}^{N_s} n_i} \quad (32)$$

The values of t_3^R and t_4^R are computed similarly by replacing t_i by t_{3i} and t_{4i} respectively.

- ii. Fit the candidate distribution to the regional average L-moment ratios t^R , t_3^R and t_4^R and mean = 1.
- iii. Use the fitted distribution to simulate a number of regions, say 500, having same record length as the observed data.
- iv. Repeat step 1 for each simulated region and the weighted regional average for the simulations are taken as t_1^R , t_2^R ... t_{500}^R and similarly for t_3^R & t_4^R .
- v. Compute the mean (τ_i^{dist}) and standard deviation (σ_i^{dist}) for the values computed in step 4 above for each L-moment statistic i .

- vi. Goodness-of-fit measure Z_i^{dist} is computed as $Z_i^{\text{dist}} = \frac{\bar{\tau}_i^R - \tau_i^{\text{dist}}}{\sigma_i^{\text{dist}}}$ (33)
- vii. Repeat the steps 2 to 6 for each of the distributions. Distribution giving the minimum $|Z_i^{\text{dist}}|$ value for the L-moment statistics is identified as the best fit distribution.

4.2 Preparation of Digital Elevation Model

The two toposheets of 1:50,000 scales obtained from Survey of India were scanned, geo-referenced and projected to 43 North zone of WGS1984 UTM projected coordinate system. Then all the contour lines, spot heights and bench marks from the toposheets are digitised to polyline and point shape files with help of ArcMap. Further, the surveyed contours lines provided by THDC are imported to ArcGIS from Auto Cad file. The DEM is prepared with help of Topo to Raster tool of spatial analyst in ArcMap, which interpolates a hydrologically correct raster surface from point, line, and polygon data. The SRTM DEM is used in for remaining upper portion of the catchment. The prepared DEM of the plant area (prepared from surveyed contour) is Figure 4.1.

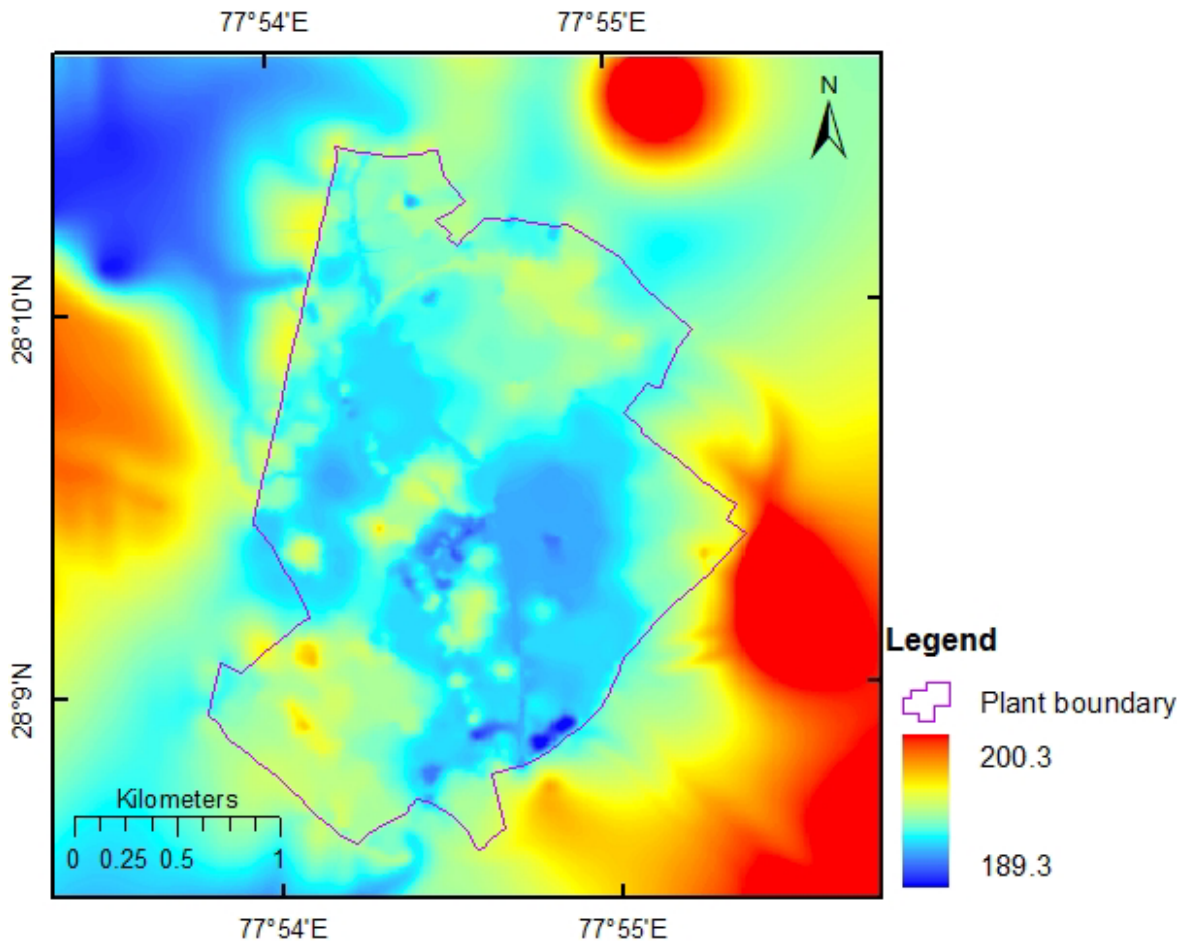


Figure 4.1: Digital elevation model of proposed plant area.

4.3 Catchment Delineation and Estimation of Catchment Characteristics

Initially a wide extent of generated DEM has been used to delineate the drainage network in and around the proposed plant area. The HEC-GeoHMS 5.0 package in ArcGIS 9.3 is tried for automatic delineation of catchments from DEM. The Aligarh drain is a natural drain and maintained by U.P. Irrigation Department and there are number of irrigation canals and road with culverts in the catchment area of drain. Moreover, the catchment area is comparatively small with very flat topography. Hence, automatic delineation of catchments from DEM was not very accurate. In such case the catchment area is delineated manually from the SOI topsheets considering the topographic features.

4.4 Derivation of Synthetic Unit Hydrograph

The various parameters of the synthetic unit hydrograph are derived from the Flood Estimation Report (CWC, 1984). Detail description of parameter and their relationships are given in Table 4.2. As mentioned in the CWC (1984) report the relationships are for 2-hour unit hydrograph (2-h UH). Hence, after deriving 2-h UH, the S-curve approach was used to develop 1-h UH.

Table 4.2 Relationships for estimating 2-h UH parameters for the study area

Sl. No.	Parameters	Relationship
1	Peak discharge of unit hydrograph per unit area of catchment ($\text{m}^3/\text{s}/\text{km}^2$)	$q_p = \frac{2.030}{(L/\sqrt{S})^{0.649}}$
2	Time in hours from the centre of unit rain fall duration to the peak of unit hydrograph.	$t_p = \frac{1.858}{q_p^{1.038}}$
3	Width of UH in hours at 50 percent of peak discharge	$W_{50} = \frac{2.217}{q_p^{0.990}}$
4	Width of UH in hours at 75 percent of peak discharge	$W_{75} = \frac{1.477}{q_p^{0.876}}$
5	Width of the rising limb of UH in hours at 50 percent peak discharge	$WR_{50} = \frac{0.812}{q_p^{0.907}}$
6	Width of the rising limb of UH in hours at 75 percent peak discharge	$WR_{75} = \frac{0.606}{q_p^{0.791}}$

7	Base width of unit hydrograph in hours	$T_B = 7.744(t_p)^{0.779}$
8	Peak discharge of unit hydrograph in m^3/s	$Q_p = q_p \times A$

Where, L = Length of the main stream (km), S = Equivalent stream slope (m/km), A= Area of the catchment (km^2).

4.5 Estimation of Flood Hydrographs

Flood hydrographs for various return periods were estimated for 1-day maximum rainfall. The steps for estimating flood hydrographs are discussed in following sections.

4.5.1 Design loss rate

Generally infiltration index and the initial losses values are derived from the available rainfall-runoff records for the severe storms in the basin. Assuming the basin would be saturated at the time of design storm the minimum infiltration rate and initial losses values would be considered. The minimum infiltration rate and minimum initial loss, thus obtained, are used to compute the effective rainfall of design storm. For this the initial losses must be subtracted first from the rainfall increments and thereafter a uniform loss rate equal to the minimum infiltration index is applied. Here, a loss rate of 0.3 cm/h is used as recommended in the CWC (1984) report.

4.5.2 Base flow for design flood

Base flow is the portion of stream flow that comes from the sum of deep subsurface flow and delayed shallow subsurface flow. CWC (1984) has analyzed total 48 events for estimating base flow. The recommended value of base flow $0.05 \text{ m}^3/\text{s}/\text{km}^2$ for Subzone-1(a) is used in this study.

4.5.3 Time adjustment of design rainfall

To determine the maximum depths for unrestricted periods and also to obtain short duration (less than 24-hours) increments of rainfall required for small and medium sized catchments, it is necessary to adjust the depth-duration curve of the design storm based on daily data. The Manual on estimation of design flood (CWC, 2001) analysed time distribution pattern of storms in the area for which adequate self recording rain-gauge data are available. In the manual, depth duration analyses of maximum rainfall depths for standard duration of 6, 12, 18, 24, 36, 48 hours etc., were obtained for each of the storms and expressed as percentage of the total storm depth. Enveloping percentages are then obtained and applied to adjust the design rainfall based on observational day data. In

absence of hourly rainfall data it is recommended to apply a factor of 1.15 to convert 1-day maximum rainfall to 24-h maximum rainfall.

4.5.4 Design storm duration

The duration of storm rainfall which causes maximum discharge in a drainage basin is called design storm duration. The flood hydrographs due to 1-day maximum rainfall is correct for clock hour (24-h) and the hourly distribution was made according to recommended in the CWC (1984) report.

4.6 Estimation of Design Flood Hydrographs

The flood hydrographs are estimated by first calculating annual maximum rainfall at each rain-gauge station for various return periods obtained from L-moments based rainfall frequency analysis. The regional rainfall is also estimated. The 24 hour rainfall is divided in to incremental hourly rainfall according to time distribution provided in the CWC (1984) report. To obtain the critical sequence of rainfall the largest of increments is placed against the peak of UH, then the next largest against the next UH ordinate and so on until all rainfall increments get arranged. Then the sequence is reversed to get the critical sequence for all spells. In case of 24-h duration rainfall the first and second 12 h blocks are interchanged to get critical situation. The design loss rate is subtracted from the hourly rainfall to obtain effective rainfall hyetograph and the direct runoff hydrograph is estimated by convoluting this effective rainfall with UH. Finally, the base flow is added to obtain design flood hydrograph.

4.7 Flow Simulation and Flood Modelling

The flow in Aligarh drain and rainfall induced catchment flooding has been modelled MIKE 21 model. The MIKE 21 has been dynamically linked to the MIKE 11 model, into a single package called MIKE FLOOD developed at the Danish Hydraulic Institute (Rungo and Olesen, 2003) is widely used for flood inundation studies. (Sanders, 2007; Chatterjee et al., 2008; Patro et al., 2009 and Pramanik et al, 2010). The methodology and the working principal of MIKE FLOOD are being discussed in the following sections.

4.7.1 Flow modelling by Mike 11 hydrodynamic model

MIKE 11 is a versatile and modular engineering tool for modelling hydrodynamic conditions in rivers, lakes/reservoirs, irrigation canals and other inland water systems. It is a fully dynamic modelling tool for the detailed analysis, design, management and operation of both simple and Complex River and channel systems (DHI, 2004). The hydrodynamic (HD) model is the nucleus of the MIKE 11 modelling system and forms the

basis for simulation of flood inundation. The HD model is capable of simulating unsteady flow in a network of rivers. The result of HD simulation consists of a time series of water level and discharges at various points along the river system. MIKE 11 HD provides a choice among three different flow descriptions, namely kinematics, diffusive and dynamic wave approaches. MIKE 11 HD solves the Saint-Venant equations to obtain the hydrodynamic state of the river networks. The post-processor tool of MIKE 11 is the MIKEVIEW, which helps to view and analyze the results through graphical and animated interfaces.

4.7.1.1 Governing Equations

The governing equations in MIKE 11 are 1-D (one-dimensional) and shallow water type, which are the modifications of basic Saint-Venant equations. These are transformed to a set of implicit finite difference equations, and solved using double sweep algorithm (Abbot and Ionescu, 1967). The computational grid comprises of alternating Q and H_I points automatically generated by the model, on the basis of user requirements (Figure 4.2). Q points are always placed midway between neighbouring H_I points. H_I points are located at cross sections or at equidistant intervals, in between if the distance between cross-sections is greater than the maximum space interval, dx specified by the users ($dx=100$ m in the present setup).

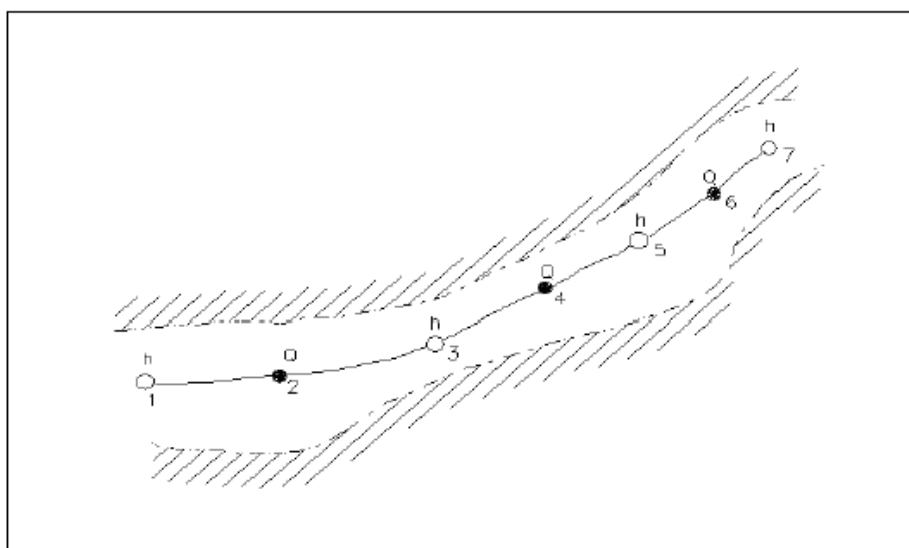


Figure 4.2 : MIKE 11 computational grids

4.7.1.2 MIKE 11 model setup

In the present study, the MIKE 11 model setup is prepared by defining following five input parameters:

1. Layout of river/ canal network
2. Cross section data definition
3. Defining hydrodynamic boundary conditions
4. Setting the HD parameters
5. Fixing the simulation parameters

4.7.1.3 Layout of river networks

The layout of MIKE 11 river networks are prepared by digitizing the scanned and geo-referenced topographical map of the study area in the MIKE 11 network editor tool. Figure 4.3 presents the digitized drainage reach of the study area. The space interval between consecutive points are kept finer ($dx=100m$) to get accurate representation of the drainage network.

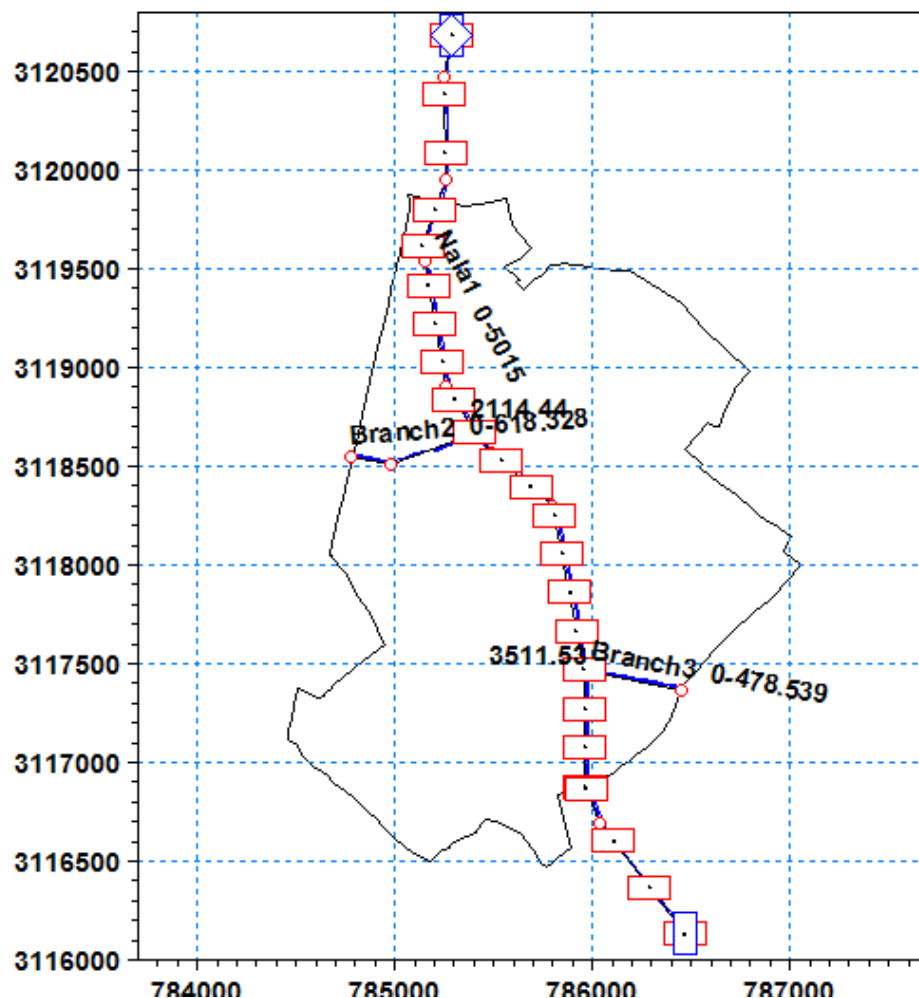


Figure 4.3 : Drainage network in MIKE-11

4.7.1.4 Cross section data definition

The topographical description of the area to be modelled is achieved through the specification of cross-sections of the drains, which lie approximately perpendicular to the direction of flow. Cross-sections are specified by a number of x - z co-ordinates where x is the transverse distance from a fixed point (often left bank top) and z is the corresponding bed elevation. Physically there should be a sufficient number of cross-sections to define adequately the variation in river shape. In the present study the actual measured cross-sections provided by THDC are used. The x - z co-ordinates are entered as raw data in the cross-section editor. The raw data are then automatically processed into a form used in the hydrodynamic calculations, i.e. the hydraulic parameters; cross-sectional area, hydraulic radius and width are calculated for a number of elevations between a minimum and a maximum which are either determined automatically or may be user specified.

4.7.1.5 Hydrodynamic boundary condition definition

Boundary conditions are required at all model boundaries, i.e. upstream and downstream ends of model branch which are not connected at any junction. The boundary conditions may be internal or external. The internal boundary condition includes the specifications at nodal points and structures, whereas the external boundary condition includes the specification of constant values of H or Q or time varying values of Q or H at start and end points. In the present setup there are three branches, each having two open hydrodynamic boundaries. The upstream boundary condition for Aligarh drain is given as design discharge. The downstream boundary condition is given as constant water level.

4.7.1.6 Setting the HD parameters

The HD parameters, in the present study, include the initial conditions of water level and discharge, friction coefficient (n) and output parameters options. Initial conditions are required to avoid the dry bed conditions. The n value is specified as 0.033. The global value for the initial condition for water level is kept at a low value of 0.01m to avoid dry bed conditions.

4.7.1.7 Fixing the simulation parameters

Before running the model simulation, control parameters such as simulation period, simulation time step, data to be stored and storage time have to be specified. The simulation periods are specified by start and end dates specified by year, month, day and hour and minute. MIKE 11 checks the actual time and reads all the data given in the time series during the simulation. There exists a versatile relationship between the time step and

the computational distance (dx) to define the Courant number given below, which is widely considered to choose the time step for the model simulation.

$$\text{Courant number } (C_R) = \frac{\Delta t(V + \sqrt{gy})}{\Delta x} \quad (36)$$

Where, Δt = time step, V = mean flow velocity (m/s), y = water level (m) and $\Delta x = dx$ -max. If there is a large value of dx , the time step should be chosen so small that the C_R value should be low. Low value of C_R is needed to avoid instability during the model simulation. In the present setup the time step is kept very low as 2 second with the dx value of 100 m. The simulation has been performed for 48 h period starting from 7/1/2012 1:00:00 AM to 7/3/2012 1:00:00 AM. These dates are hypothetical.

4.7.1.8 Calibration and validation of MIKE 11

Calibration of a model is the process of adjusting model parameters to obtain a close agreement between the observed and the simulated outputs. Validation of the calibrated model is essential to check the calibration precision. Observed stage/discharge data of the river are not available for the calibration and validation process.

4.7.2 Two-Dimensional flow modelling by Mike 21 HD model

MIKE 21 HD is the basic computational hydrodynamic model of the entire MIKE 21 system. MIKE 21 HD simulates the water level variations and flows in response to a variety of forcing functions in creeks, rivers, lakes, estuaries, bays and coastal areas. The water levels and flows are resolved on a rectangular grid covering the area of interest. MIKE 21 HD is able to model the wide range of conditions likely to be encountered in inland waterways and their floodplains.

MIKE 21 system solves the full, time dependent, non-linear equations of continuity and conservation of momentum equation as given below.

$$\frac{\partial \zeta}{\partial t} + \frac{\partial p}{\partial x} + \frac{\partial q}{\partial y} = \frac{\partial d}{\partial t} \quad (34)$$

$$\begin{aligned} \frac{\partial p}{\partial t} + \frac{\partial}{\partial x} \left(\frac{p^2}{h} \right) + \frac{\partial}{\partial y} \left(\frac{pq}{h} \right) + gh \frac{\partial \zeta}{\partial x} + \frac{gp\sqrt{(p^2 + q^2)}}{C^2 \cdot h^2} \\ - \frac{1}{\rho_w} \left[\frac{\partial}{\partial x} (h_{xx}) + \frac{\partial}{\partial y} (h_{xy}) \right] - \Omega_q - f(V)V_x + \frac{h\partial}{\rho_w \partial x} (p_a) = 0 \end{aligned} \quad (35)$$

Where, ζ = surface elevation (m), t = time (sec), p = flux density in x direction ($\text{m}^3/\text{s}/\text{m}$), x, y = space coordinates (m), d = time varying water depth (m), h = water depth (m), g = acceleration due to gravity (m/s^2), C = Chezy resistance coefficient ($\text{m}^{1/2}/\text{s}$) (in the model resistance may also be defined using Manning's coefficient and the equation is transformed accordingly), Ω_q = Coriolis parameter (s^{-1}), ρ_w = density of water and $f(V)$ = wind friction factor.

The solution is resolved using an implicit finite difference scheme of second order accuracy. MIKE 21 includes a special statistical feature for inundation mapping. Often information like the maximum depth, the time of the maximum depth, the maximum velocity and the time of the maximum velocity are sought as the most significant information of a flood study. This information is easily determined on the basis of output data from MIKE 21 using the statistical post-processing routine of the MIKE 21 package.

4.7.2.1 MIKE 21 HD model set up

For the simulation of MIKE FLOOD, MIKE 21 set up is required, because the former is a coupled unit of both MIKE 11 and MIKE 21 simulations. MIKE 21 model has many basic input parameters like; bathymetry, simulation period, boundary, source and sink, mass budget, flood and dry, and hydrodynamic parameters like; initial surface elevation, boundary, source and sink, eddy viscosity, resistance, wave radiation, wind condition etc. In the present study, parameters defining bathymetry, point source, precipitation initial surface elevation, flood and dry thresholds have been used. The resolution of the prepared bathymetry is $10\text{m} \times 10\text{m}$. The computational time step (Δt) is set to lower value of 2 seconds for different simulations. The prepared MIKE 21 setup, in the present study, is executed to check the error, however the simulation file (*.m21) is used as input to execute MIKE FLOOD, which is described below.

4.7.3 Flood inundation modelling by MIKE FLOOD

MIKE FLOOD couples MIKE 11 and MIKE 21 into a single system. Using a coupled approach, MIKE FLOOD enables to extract the best features of both MIKE 11 and MIKE 21 to simulate floods, while at the same time avoiding many of the limitations of resolution and accuracy encountered when using MIKE 11 or MIKE 21 separately. There are four types of links available in MIKE FLOOD to couple the MIKE 11 river system with the MIKE 21 cells. They include, Standard link, Lateral links, Structure link and Zero flow link. The standard link is the standard linkage in MIKE FLOOD, where one or more MIKE 21 cells are linked to the end of a MIKE 11 branch. This type of link is useful for connecting a detailed MIKE 21 grid into a broader MIKE 11 network, or to connect an

internal structure or feature inside a MIKE 21 grid. The lateral link allows a string of MIKE21 cells to be laterally linked to a given reach in MIKE 11, either a section of a branch or an entire branch. Flow through the lateral link is calculated using a weir equation or a $Q-H$ table. This type of link is particularly useful for simulating overflow from a river channel onto a floodplain, where flow over the river levee is calculated using a weir equation. The structure link takes the flow terms from a structure in MIKE 11 and inserts them directly into the momentum equations of MIKE 21. The zero flow link is defined to prohibit the flow across the cell in a particular direction of X or Y. In this study MIKE 21 model setup is prepared with rainfall as input.

4.8 Safe Grade Elevation

The maximum flood level or the high water level (above Indian Mean Sea Level, IMSL) is arrived at from the model results for the most severe flooding condition at the plant site. National Disaster Management Authority, Government of India recommends the plinth levels of all the buildings 0.6 m above the drainage/ flood submersion lines (NDMA, 2008). In fact sufficient freeboard provides an extra measure of flood protection above the base flood elevation to account for waves, debris, hydraulic surge or insufficient data. The NDMA guideline recommends preparing the flood inundation maps using topographical maps at 1:10,000 scale with contours of 0.5/1.0 m and digital elevation model (NDMA, 2008). In present study, the main source of flooding is local site rainfall and overflow from the Aligarh drain.

4.9 Drainage Design

The drain around proposed plant area is designed to safely carry the runoff generated due to various return period rainfall. The cross-section of the drains are designed according to the Indian Standard, IS 10430:2000 (BIS, 2006). Trapezoidal section drains with side slope 1.5:1 (H:V) and longitudinal slope of 0.001 m/m (1.0 m/km) is designed using Mannings formula. The drain sections are designed for velocity less than 2.0 m/s and Manning's roughness coefficient (n) values of 0.015. The Free board recommended in the standard and used in this study are: 0.75 m for discharge greater than $10 \text{ m}^3/\text{s}$ and 0.6 m for discharge less than $10 \text{ m}^3/\text{s}$. A typical cross-section of the drain is shown in Figure 4.4.

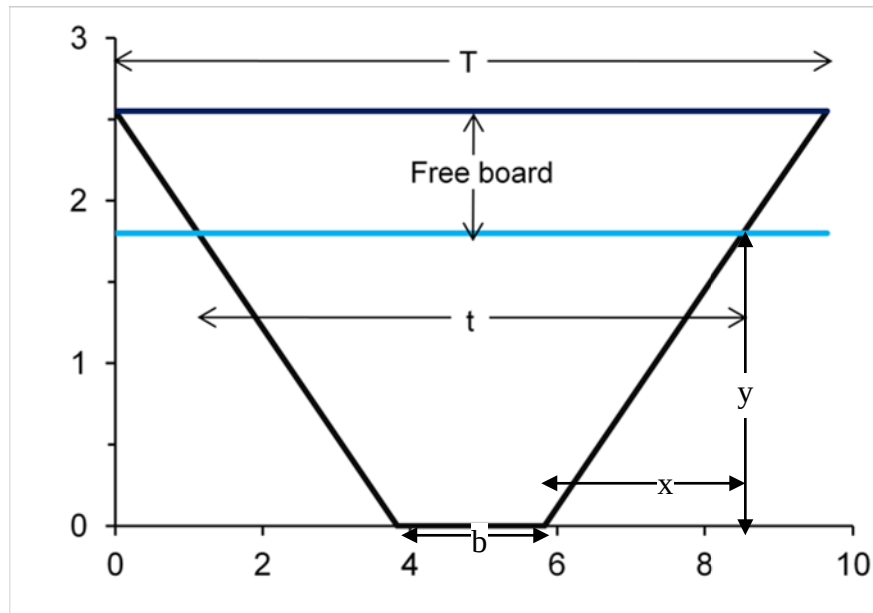


Figure 4.4: Typical Cross-section of the drain.

$$Q=VA \quad V = \frac{k}{n} R^{2/3} S^{1/2} \quad R = \frac{A}{P} \quad A = \frac{y}{2}(b+T)$$

$$P = b + y \left(\sqrt{1+z_1^2} + \sqrt{1+z_2^2} \right) \quad T = b + y(z_1 + z_2)$$

$$Z = \frac{x}{y}$$

5 ANALYSIS AND RESULTS

5.1 Estimation of 1-day Annual Maximum Rainfall

The annual 1-day maximum rainfall series for all three stations are given in Figure 5.1 (Tabular value given in annexure II). The highest 1-day annual maximum rainfall observed at Aligarh Obsy, Bulandshahr Obsy and Khurja are 327.2 mm, 220.0 mm and 279.4 mm respectively.

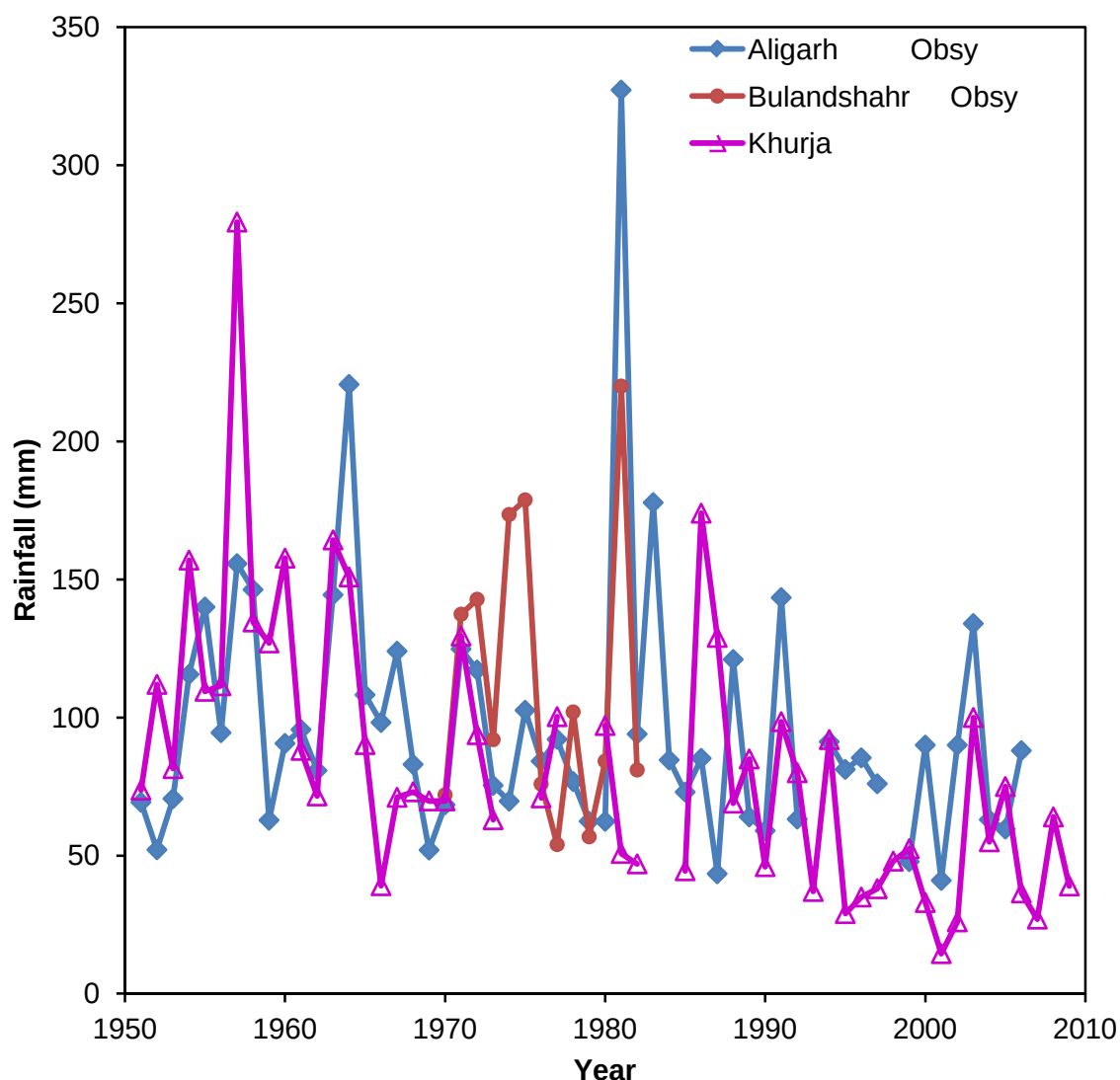


Figure 5.1 : Annual 1-day maximum rainfall.

5.2 Estimation of 1-Day Rainfall of Various Return Periods using L-Moments Based Rainfall Frequency Analysis

Estimation of 1-day rainfall of various return periods using the L-moments based rainfall frequency analysis is described as follows.

5.2.1 Identification of robust distribution for 1-day maximum rainfall

Rainfall frequency analysis has been carried out using the L-moments approach. The robust frequency distribution for the study area has been identified based on Z_i^{dist} Statistic and L-moment ratio diagram. The Z_i^{dist} Statistic for various distributions for each three rain-gauge stations are given in Table 5.1. Figure 5.2 to Figure 5.4 show the L-moments ratio diagram for each of three rain-gauge stations and Figure 5.5 show the L-moments ratio diagram for regional of three rain-gauge stations. Based on the Z_i^{dist} Statistic and L-moment ratio diagram robust frequency distributions have been identified for the three rain-gauges and the regional rainfall frequency analysis procedure. The parameters for various distributions for 1-day maximum rainfall are given in Table 5.2. The first row of the parameter values (Table 5.2) shows the robust identified frequency distributions for each of the cases. The growth factors or site-specific scale factor ($R_T/\bar{R}$) are computed by dividing rainfall quantile (R_T) by the annual mean maximum rainfall of a rain gauge station ($\bar{R}$) as given in Table 5.3. The 1-day maximum rainfall for various return periods are estimated by multiplying the respective growth factor with mean annual maximum rainfall of the station as given in Table 5.4. The rainfall for 50 year return period is maximum at Bulandshahr (26.26 cm) and the regional rainfall (28.99 cm) is maximum for 100 year return period are considered for further analysis as conservative approach.

Table 5.1 Z_i^{dist} – Statistic of various distributions for 1-day annual maximum rainfall

S. No.	Distribution	Z_i^{dist} –statistic
Aligarh		
1.	Generalized Normal (GLO)	-0.38
2.	Generalized Extreme Value (GEV)	-0.65
3.	Generalized logistic (GNO)	-0.91
4.	Pearson Type III (PE3)	-1.35
5.	Generalized Pareto (GPA)	-1.39
Bulandshahr		
1.	Generalized Pareto (GPA)	-0.14
2.	Pearson Type III (PE3)	-0.16
3.	Generalized logistic (GNO)	-0.36
4.	Generalized Extreme Value (GEV)	-0.48
5.	Generalized Normal (GLO)	-0.73

S. No.	Distribution	Z_i^{dist} -statistic
Khurja		
1.	Generalized Extreme Value (GEV)	0.06
2.	Generalized Normal (GNO)	-0.13
3.	Pearson Type III (PE3)	-0.50
4.	Generalized logistic (GLO)	-0.64
5.	Generalized Pareto (GPA)	-1.30
Regional		
1.	Generalized Extreme Value (GEV)	-0.30
2.	Generalized Normal (GLO)	0.31
3.	Generalized logistic (GNO)	-0.67
4.	Pearson Type III (PE3)	-1.30
5.	Generalized Pareto (GPA)	-1.87

Table 5.2 Parameters of various distributions for 1-day annual maximum rainfall

Distribution	Parameters of the Distribution				
Aligarh					
GLO	$\xi = 0.880$	$\alpha = 0.197$	$k = -0.325$		
GEV	$\xi = 0.773$	$\alpha = 0.263$	$K = -0.228$		
GNO	$\xi = 0.868$	$\alpha = 0.345$	$k = -0.682$		
PE3	$\mu = 1.000$	$\sigma = 0.470$	$\gamma = 1.949$		
GPA	$\xi = 0.523$	$\alpha = 0.486$	$k = -0.019$		
Bulandshahr					
GLO	$\xi = 0.894$	$\alpha = 0.242$	$k = -0.246$		
GEV	$\xi = 0.758$	$\alpha = 0.344$	$K = -0.116$		
GNO	$\xi = 0.883$	$\alpha = 0.426$	$k = -0.512$		
PE3	$\mu = 1.000$	$\sigma = 0.509$	$\gamma = 1.484$		
GPA	$\xi = 0.407$	$\alpha = 0.717$	$k = 0.209$		
Khurja					
GLO	$\xi = 0.890$	$\alpha = 0.282$	$k = -0.224$		
GEV	$\xi = 0.728$	$\alpha = 0.408$	$K = -0.083$		
GNO	$\xi = 0.878$	$\alpha = 0.497$	$k = -0.465$		
PE3	$\mu = 1.000$	$\sigma = 0.576$	$\gamma = 1.353$		
GPA	$\xi = 0.304$	$\alpha = 0.883$	$k = -0.267$		

Distribution	Parameters of the Distribution				
Regional					
GLO	$\xi = 0.883$	$\alpha = 0.239$	$k = -0.272$		
GEV	$\xi = 0.749$	$\alpha = 0.332$	$K = -0.153$		
GNO	$\xi = 0.871$	$\alpha = 0.420$	$k = -0.566$		
PE3	$\mu = 1.000$	$\sigma = 0.521$	$\gamma = 1.634$		
WAK	$\xi = 0.308$	$\alpha = 1.494$	$\beta = 5.010$	$\gamma = 0.391$	$\delta = -0.119$

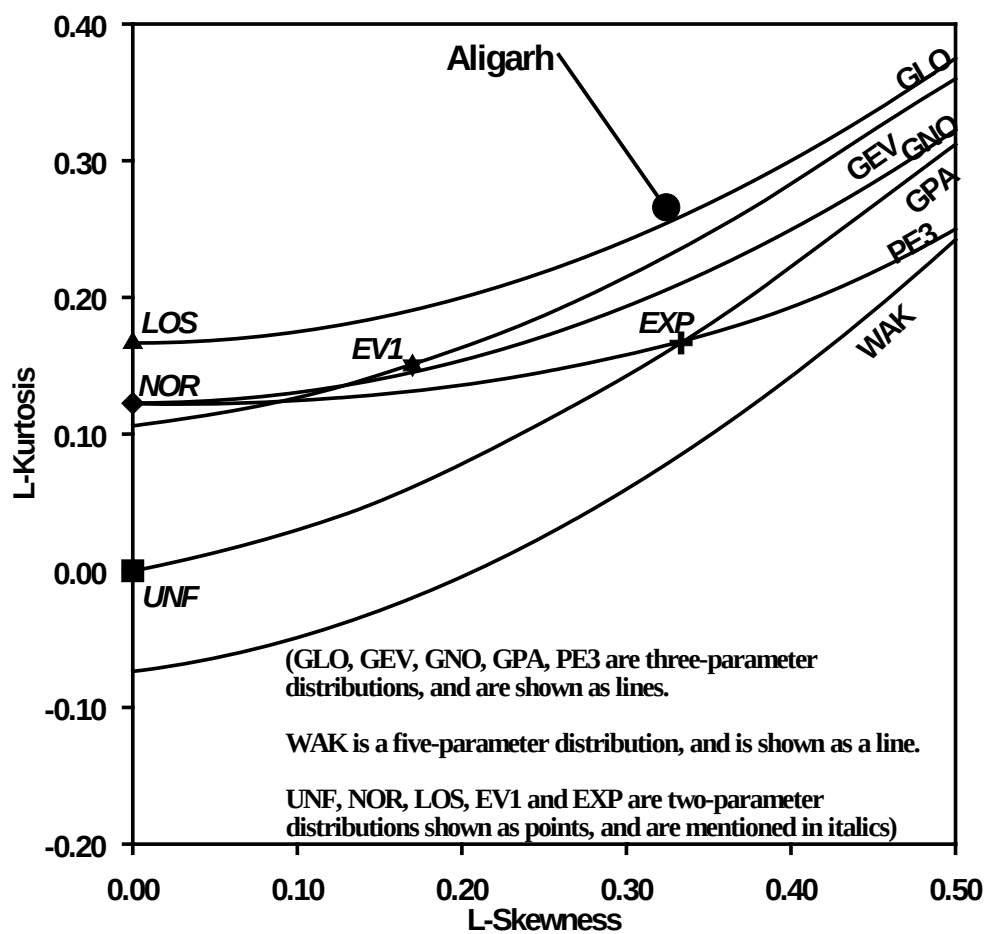


Figure 5.2: L-moments ratio diagram for Aligarh for 1-day annual maximum rainfall

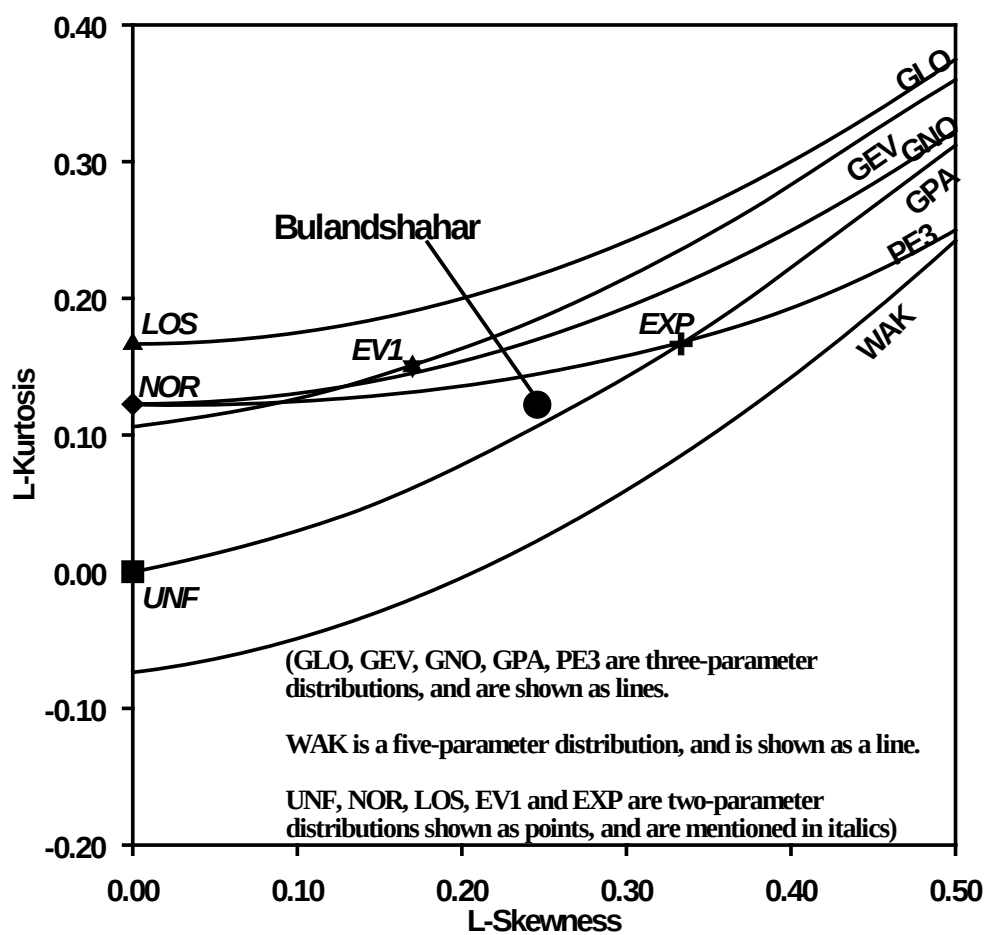


Figure 5.3: L-moments ratio diagram for Bulandshahar for 1-day annual maximum rainfall

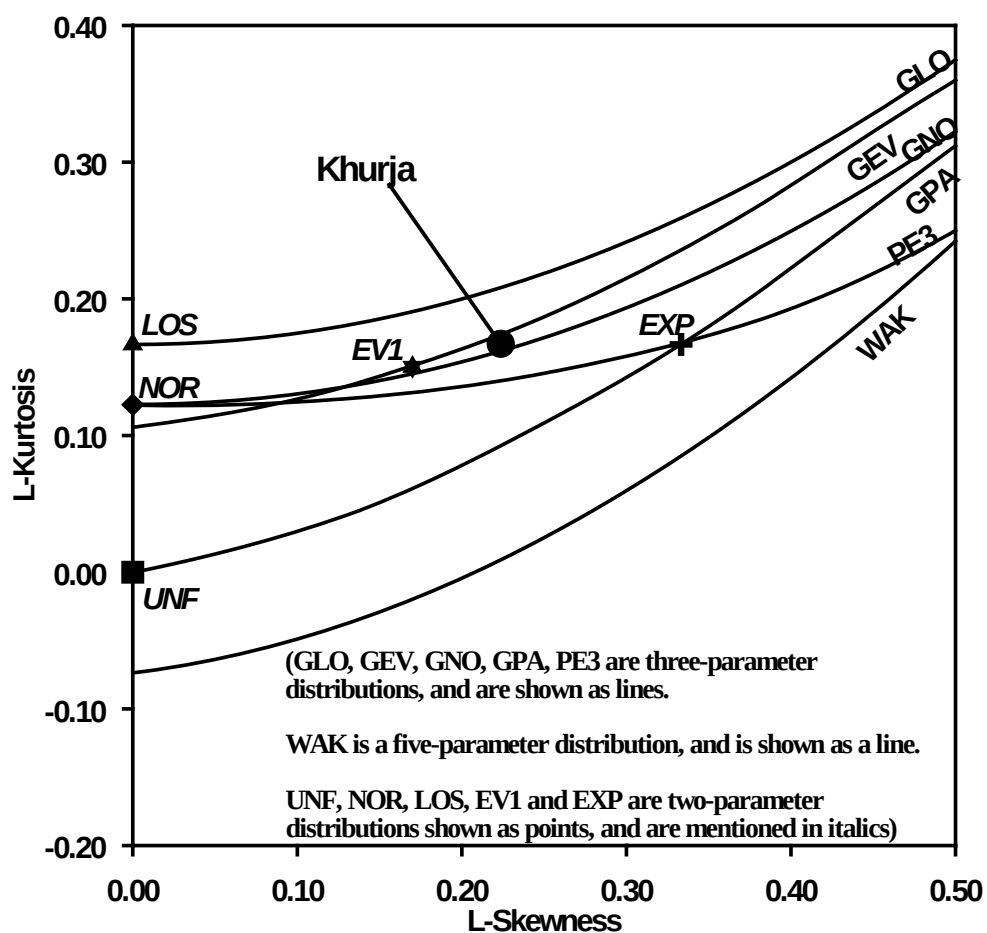


Figure 5.4: L-moments ratio diagram for Khurja for 1-day annual maximum rainfall

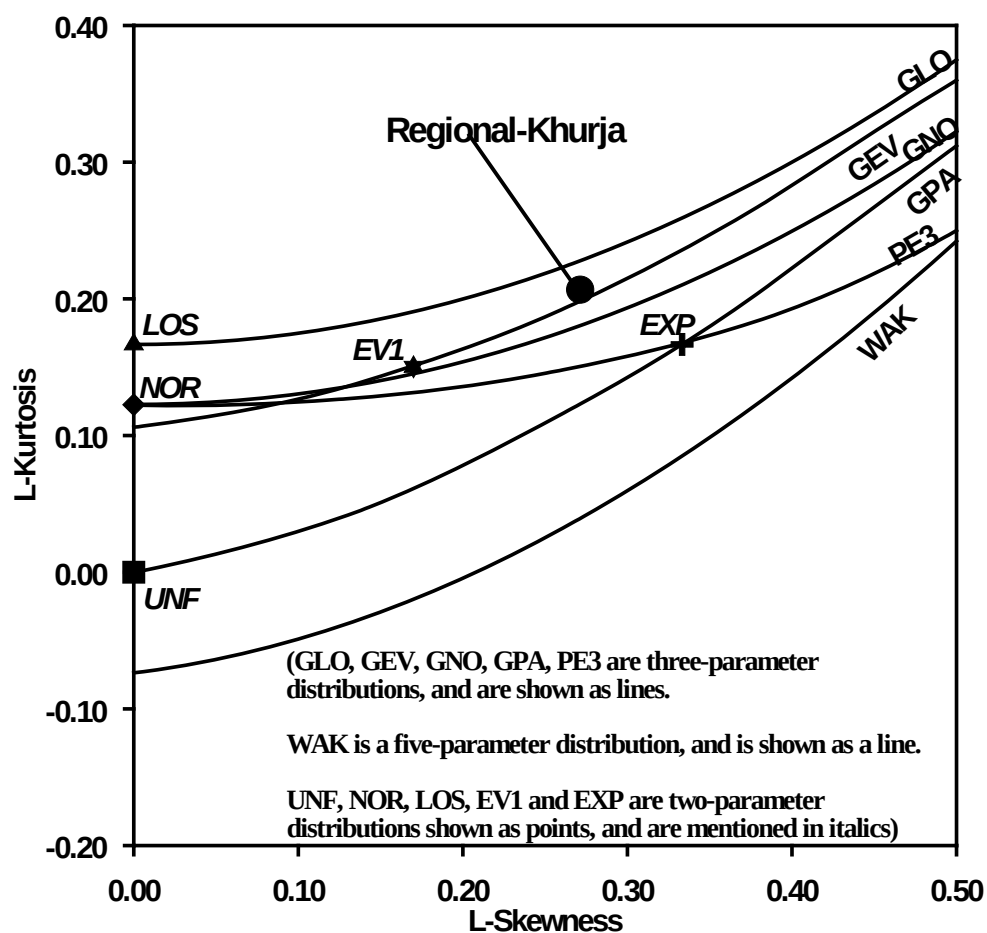


Figure 5.5: L-moments ratio diagram for Regional for 1-day annual maximum rainfall

Table 5.3 Values of growth factors ($R_T/\bar{R}$) for 1-day annual maximum rainfall

Raingauge	Return periods (Year)							
	2	10	25	50	100	200	500	1000
Aligarh	0.880	1.513	1.978	2.424	2.976	3.664	4.844	6.000
Bulandshahr	0.870	1.717	2.086	2.320	2.526	2.702	2.900	3.026
Khurja	0.880	1.737	2.222	2.607	3.012	3.440	4.043	4.530
Regional	0.875	1.642	2.120	2.523	2.967	3.460	4.195	4.800

Table 5.4 1-day annual maximum rainfall (mm) for various return periods

Raingauge	Return periods (Year)							
	2	10	25	50	100	200	500	1000
Aligarh	85.1	146.3	191.3	234.5	287.9	354.4	468.6	580.4
Bulandshahr	98.4	194.2	235.9	262.6	285.7	305.6	328.0	342.3
Khurja	73.3	144.6	185.0	217.0	250.7	286.4	336.5	377.1
Regional	85.5	160.4	207.1	246.5	289.9	338.0	409.8	471.2

5.3 Estimation of Synthetic Unit Hydrograph

The various catchments delineated are shown in Figure 5.6. The length of Aligarh drain upto Ghatal cut is 9.158 km and length of Aligarh drain from entry to plant boundary to Ghatal cut is 2.66 km. Hence, the Length of Aligarh drain upto plant boundary is 6.5 km. The longitudinal slope is taken as per UPID. The catchment characteristics of the basin is given Table 5.5 and parameters of UH derived using these characteristics are given in Table 5.6. The 1-h Synthetic Unit Hydrograph plotted using above parameters is shown in Figure 5.7 and the ordinates are given in Table 5.7.

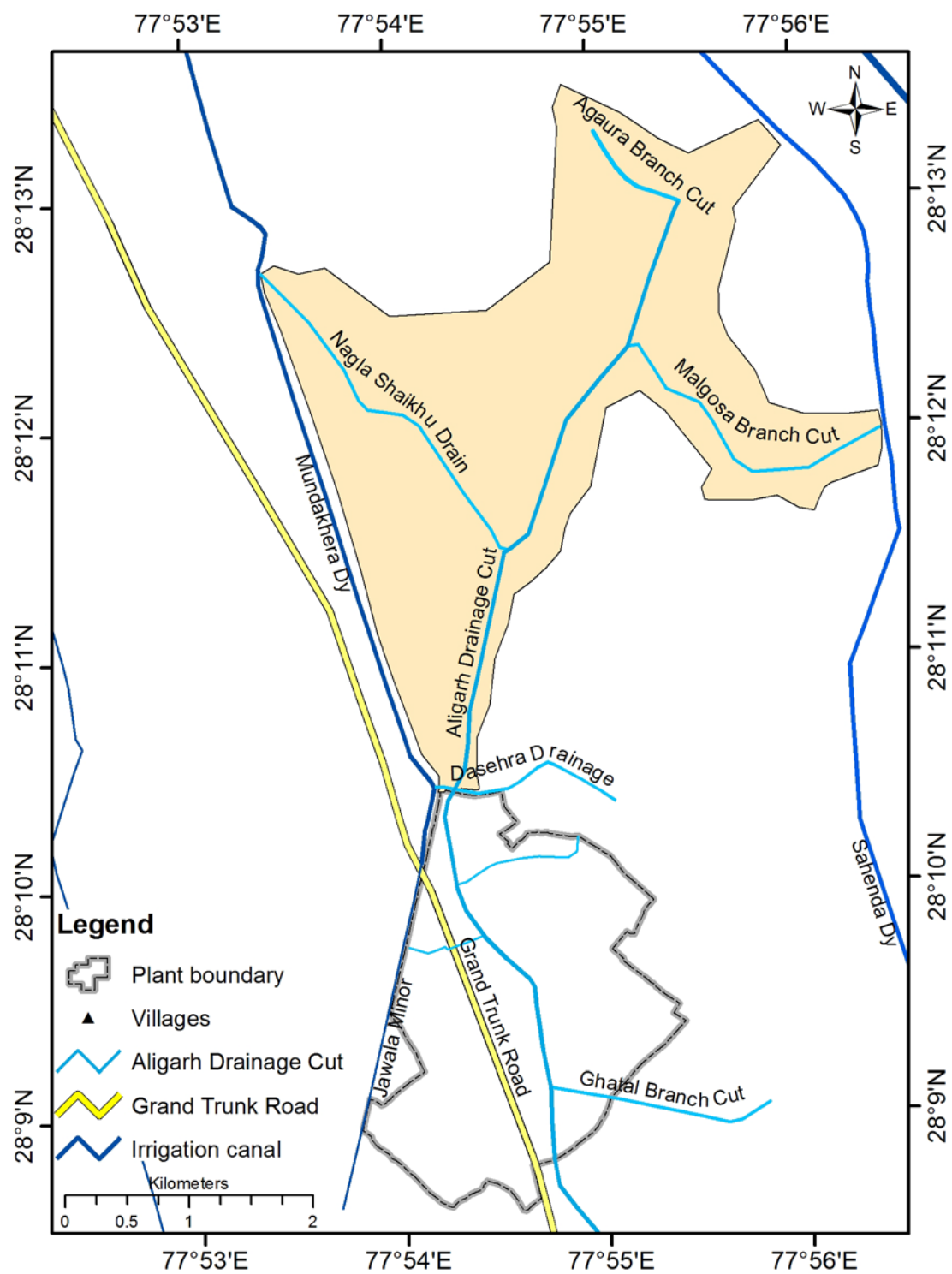


Figure 5.6: Delineated Catchment area

Table 5.5 Catchment characteristics

Sl. No.	Parameters & Relationship	Values
1	Length of main stream (L) (km)	6.5
2	Equivalent slope (S) (m/km)	0.34
3	Area (A) (km ²)	10.5

Table 5.6 Parameters of Synthetic Unit Hydrograph.

Sl. No.	Parameters & Relationship	Values
1	$q_p = \frac{2.030}{\left(L/\sqrt{S}\right)^{0.649}}$	0.42
2	$t_p = \frac{1.858}{q_p^{1.038}}$	4.5
3	$W_{50} = \frac{2.217}{q_p^{0.990}}$	5.17
4	$W_{75} = \frac{1.477}{q_p^{0.876}}$	3.12
5	$WR_{50} = \frac{0.812}{q_p^{0.907}}$	1.76
6	$WR_{75} = \frac{0.606}{q_p^{0.791}}$	1.93
7	$T_B = 7.744(t_p)^{0.779}$	24.99
8	$Q_p = q_p \times A$	4.46

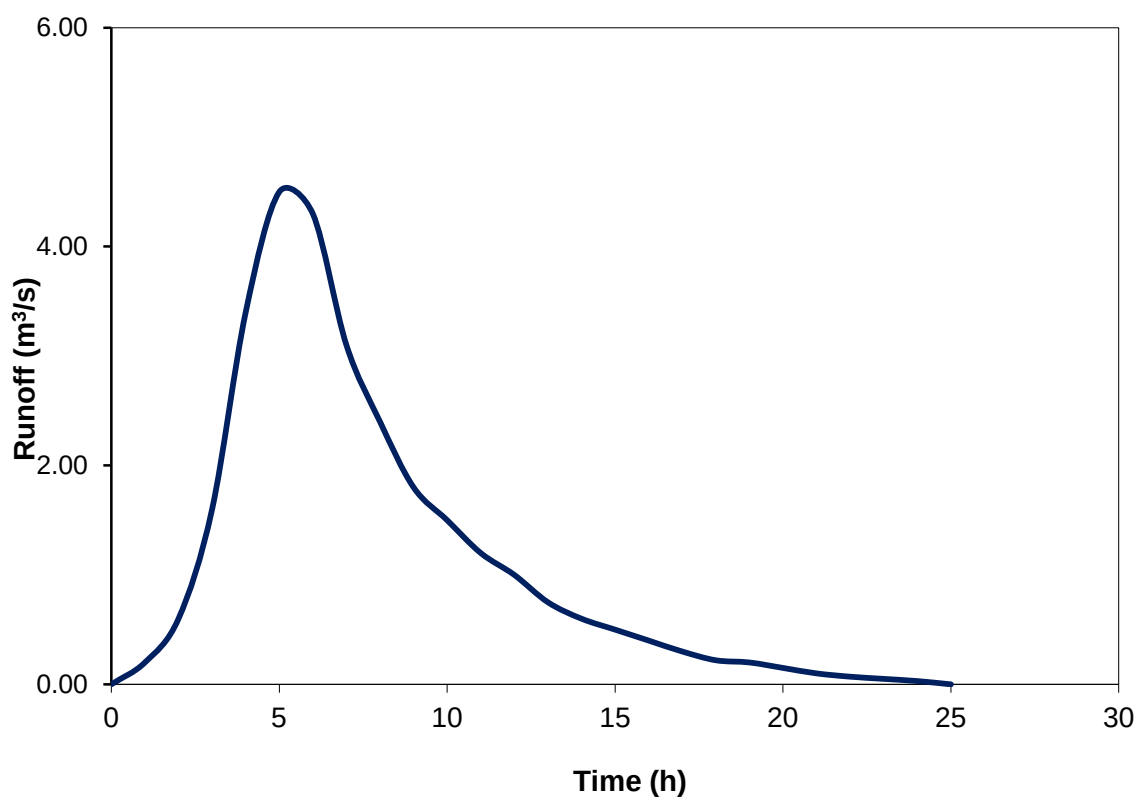


Figure 5.7: 1-h unit hydrograph.

Table 5.7 Ordinates of 1-h unit hydrograph.

Time (h)	Runoff (m ³ /s)	Time (h)	Runoff (m ³ /s)
0	0.00	13	0.75
1	0.20	14	0.60
2	0.60	15	0.50
3	1.60	16	0.40
4	3.40	17	0.30
5	4.50	18	0.22
6	4.30	19	0.20
7	3.10	20	0.15
8	2.40	21	0.10
9	1.80	22	0.07
10	1.50	23	0.05
11	1.20	24	0.03
12	1.00	25	0.00

5.3.1 Base flow for design flood

On this basis, the design base flow of $0.05 \text{ m}^3/\text{s}$ per sq. km. of the catchment area has been recommended and in this study also the recommended base flow has been adopted. In the present study base flow for the sub basins is found to be $0.525 \text{ m}^3/\text{s}$.

5.3.2 Temporal Distribution

The temporal rainfall distribution for 24 h duration is provided in the in the CWC report. This provides rainfall increments at unit duration. Then, the incremental depths are arranged in critical order for each bells of 12 h duration as mentioned in the Manual on Estimation of Design Flood (CWC, 2001). For this the largest of increments is placed against the peak of UH, then the next largest against the next UH ordinate and so on until all rainfall increments get arranged. Then the sequence is reversed to get the critical sequence for all spells. In case of 24-h duration rainfall the first and second 12 h blocks are interchanged to get critical situation.

5.4 Estimation of Flood Hydrographs

The details of estimation of flood hydrographs using two methods are discussed as follows.

5.4.1 Estimation of Flood hydrographs using 1-day annual maximum rainfall

After applying clock hour correction the 2, 10, 25, 50 and 100 year return period 24-h maximum areal rainfalls are found to be 9.83 cm, 18.45 cm, 23.82 cm, 28.35 cm and 33.35 cm respectively. The time distribution of rainfall was adopted according to the CWC (1984) report. The Cumulative rainfall distribution for 24-h storm duration is show in Figure 5.8. The hourly rainfall hyetograph for 24 h duration for 50 year and 100 year return period are shown in Figure 5.9. Base flow has been estimated using the $0.05 \text{ m}^3/\text{s}/\text{km}^2$ for the catchment area and added to estimated direct runoff hydrograph for estimating flood hydrographs. The Peak flood for 2, 10, 25, 50 and 100 year return periods are found to be $20.13 \text{ m}^3/\text{s}$, $44.06 \text{ m}^3/\text{s}$, $59.1 \text{ m}^3/\text{s}$, $71.59 \text{ m}^3/\text{s}$ and $85.88 \text{ m}^3/\text{s}$ respectively and the flood hydrographs are shown in Figure 5.10. The ordinates of flood hydrographs are given in annexure III.

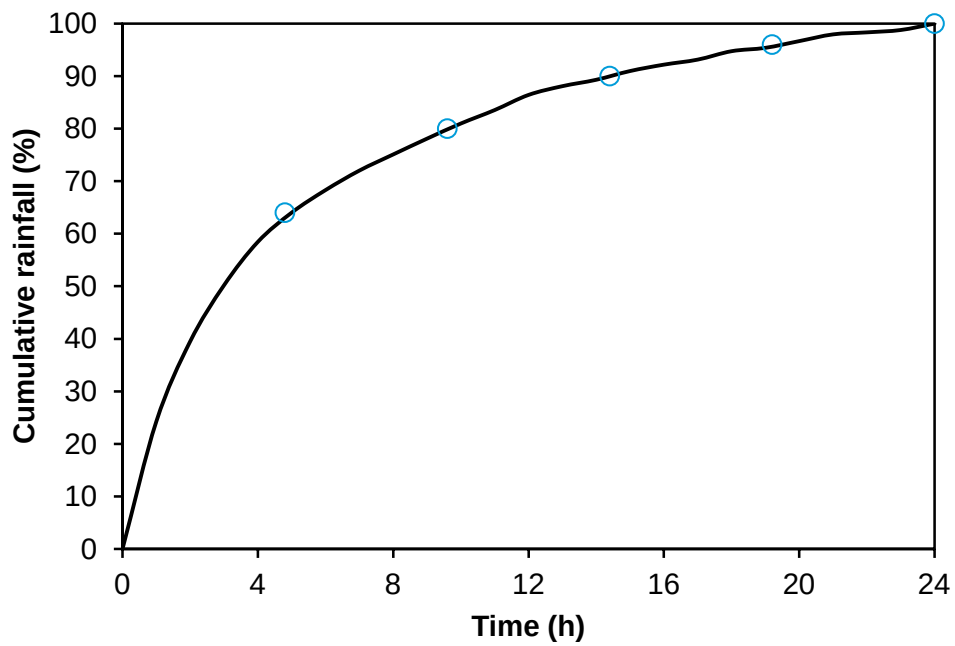


Figure 5.8: Time duration curve for the 24-h rainfall

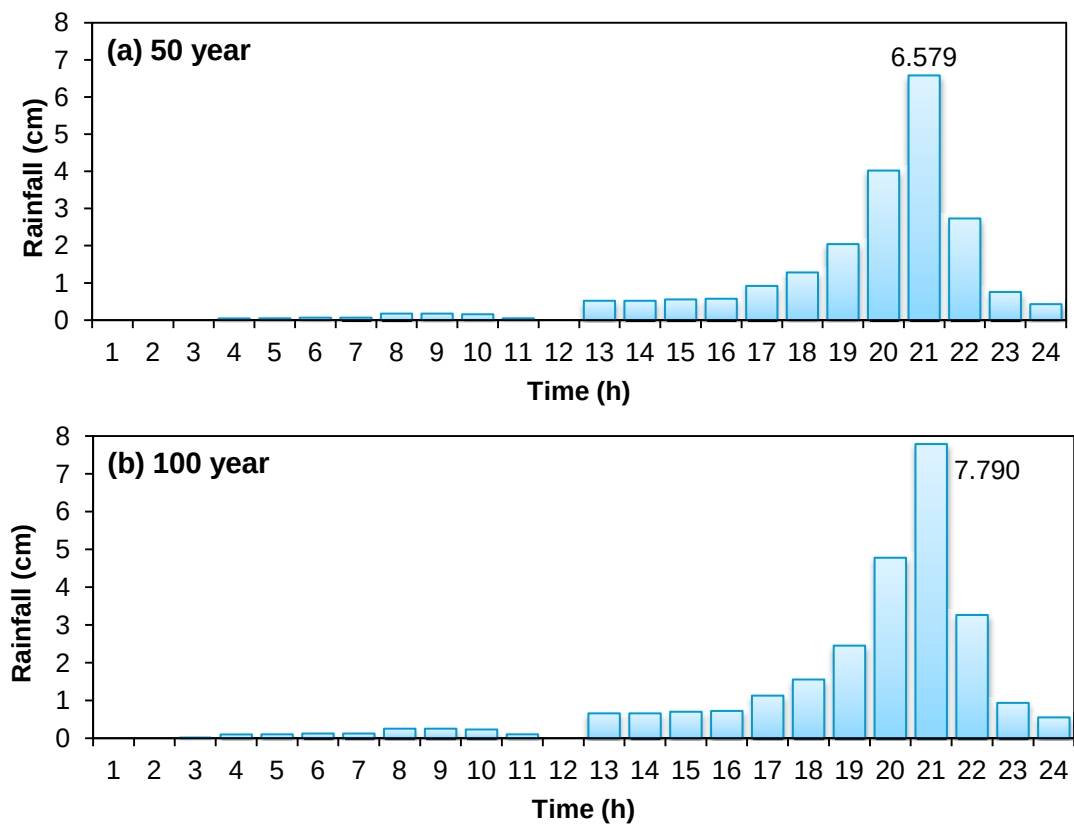


Figure 5.9: Rainfall hyetograph for 1-day maximum rainfall

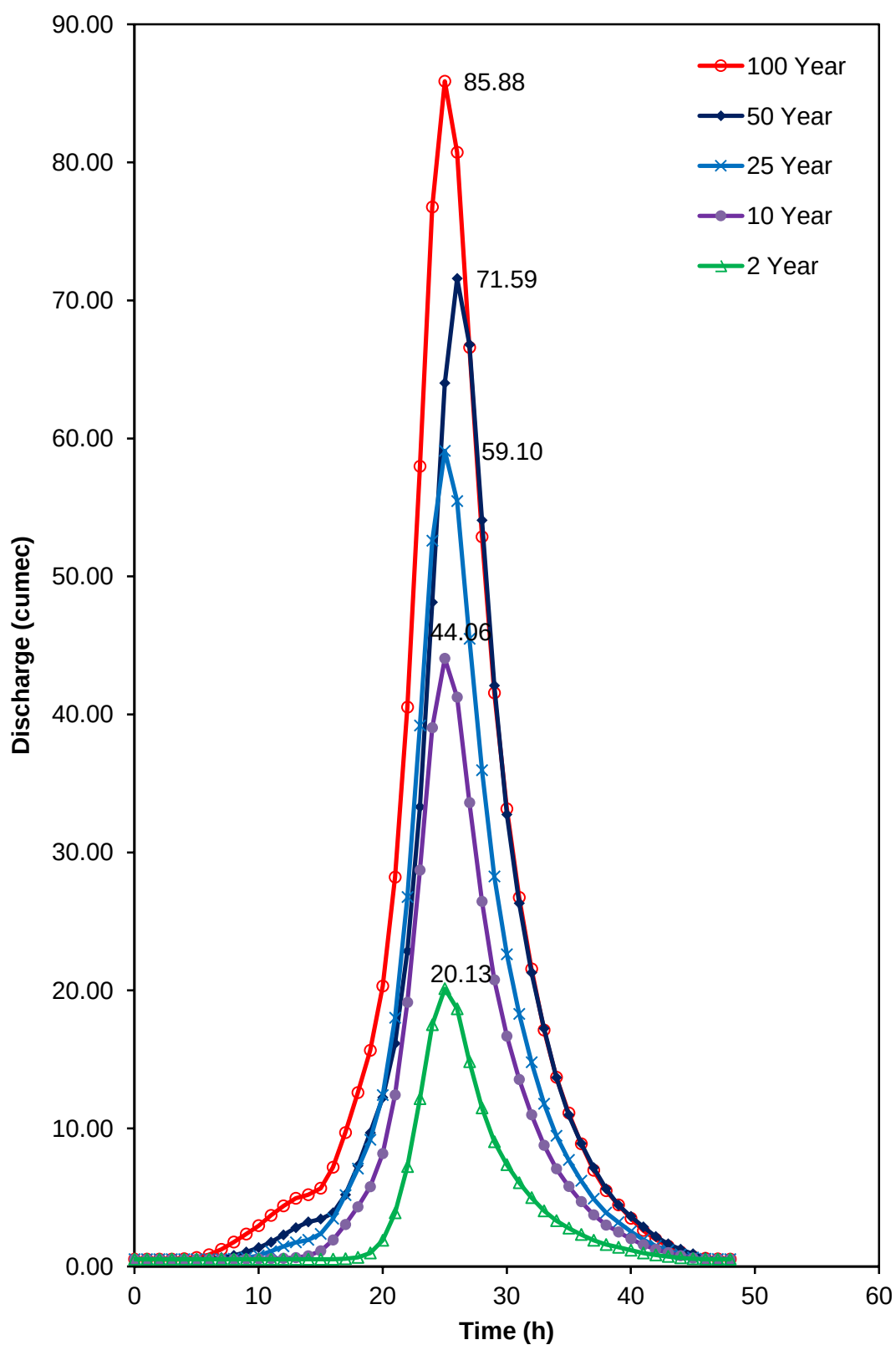


Figure 5.10: Design flood hydrographs for various return periods resulting from 1-day annual maximum rainfall.

5.5 Flood simulation

The flood at proposed plant site may occur due to factors like overflow from the Aligarh drain, at site high rainfall and runoff from the surrounding areas.

5.5.1 Flow through Aligarh drain

The design discharge at inlet and outlet of Aligarh drain at plant area provided by UPID are $6.3 \text{ m}^3/\text{s}$ and $7.1 \text{ m}^3/\text{s}$ respectively. The Mike-11 setup of Aligarh drain is shown in Figure 5.11. It is observed that the drain is unable to carry the design discharge in present condition. Moreover, the surveyed cross-section shows that the depth of drain varies from 0.53 m to 2.28 m in width of 10 m. Further, the discharge in Aligarh drain estimated for 50 year return period rainfall is very high compared to the discharge provided by UPID. Hence, the sections needed modification to carry this high discharge.

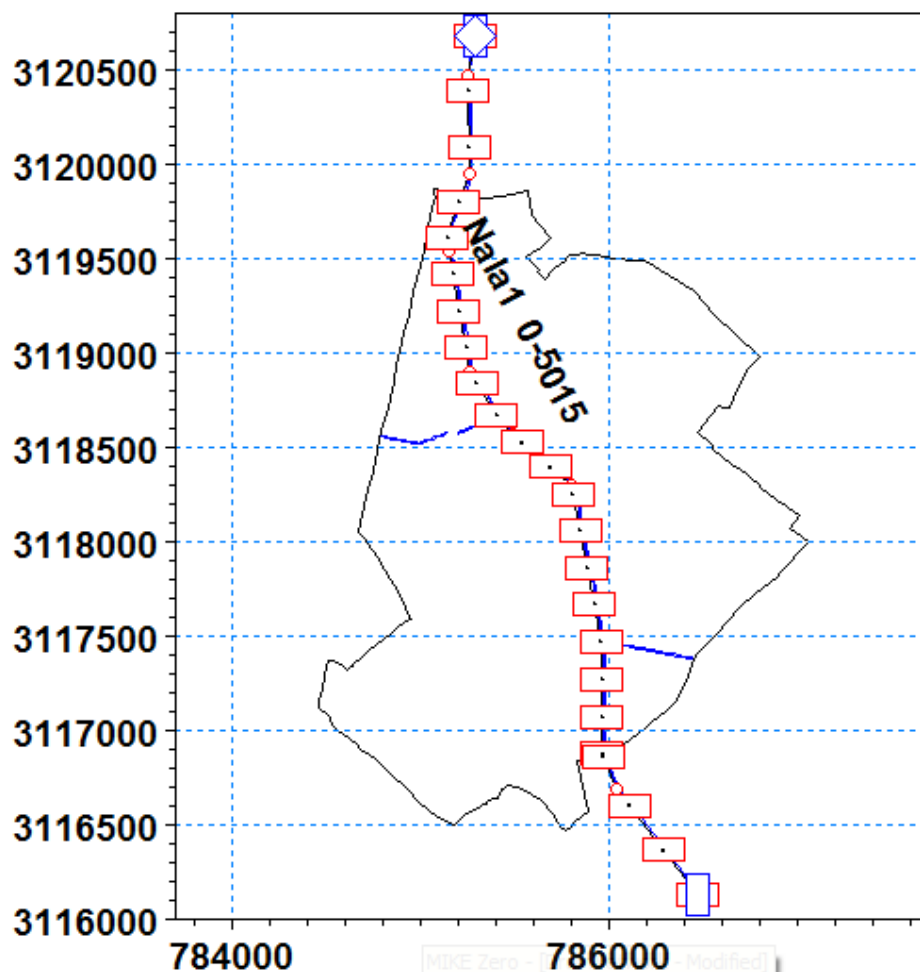


Figure 5.11: Mike-11 setup of Aligarh drain.

5.5.2 Modification of the Aligarh drain

The existing and proposed aligned Aligarh drain is shown in Figure 5.12. The existing ground surface elevation and proposed bed level profiles of the realigned section of Aligarh drain is shown in Figure 5.15. The existing cross-section of Aligarh drain at inlet and outlet is shown in the Figure 5.13. The drain sections are surveyed for 10m width. Here, the proposed modified drain section given in Figure 5.14 are designed for 10 m width due to the space constraints and the corresponding flooding due to 100, 50, 25 and 10 year return period rainfall are studied. The Aligarh drain is designed for lined trapezoidal section with Manning's roughness of 0.015; 5 m base width and 1.5 m depth. The side slopes are 1.5:1 (H:V) and longitudinal slope is 0.35 m/km. Such section will be able to safely carry a discharge of $15.1 \text{ m}^3/\text{s}$ with a velocity of 1.3 m/s.

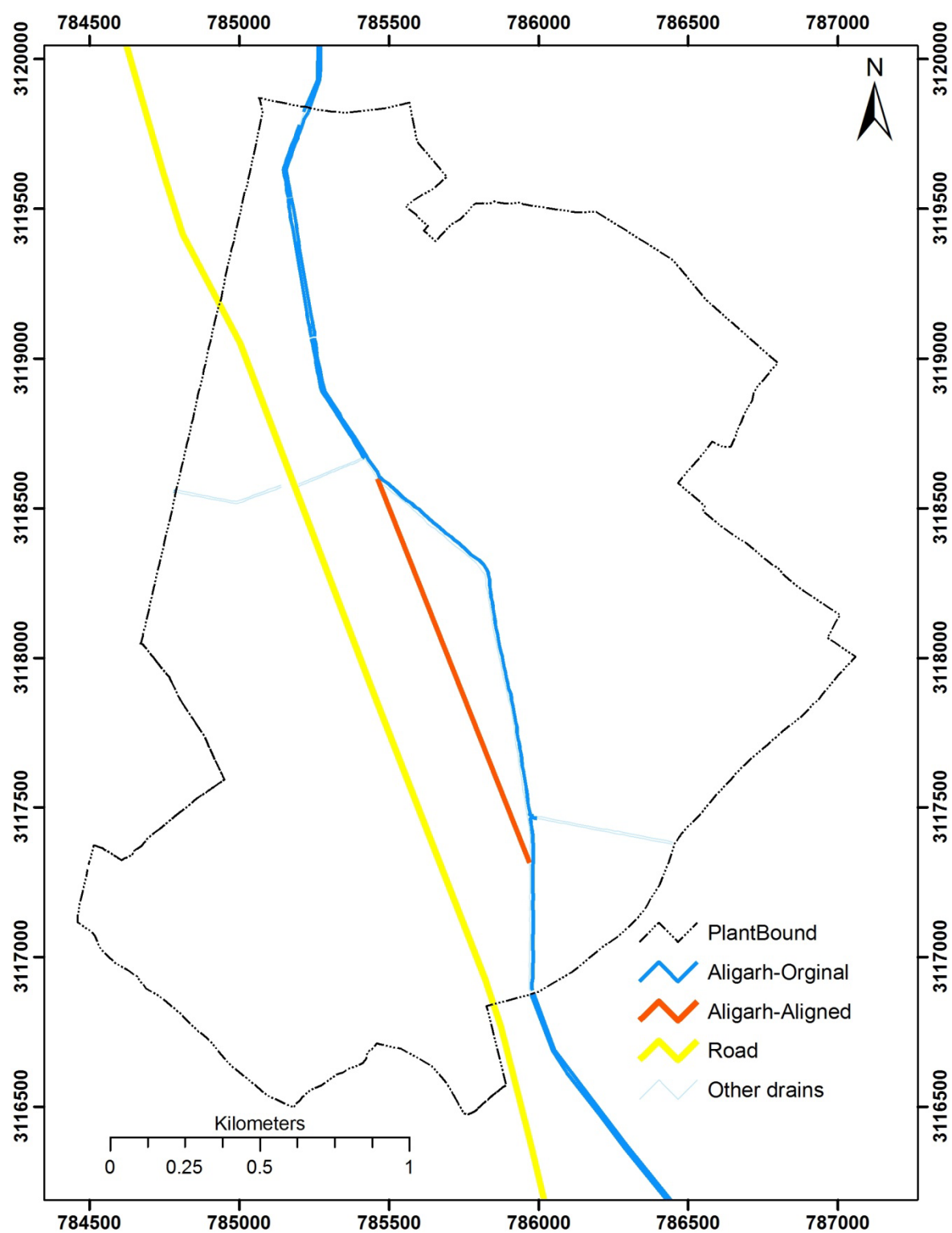


Figure 5.12: Existing and proposed re aligned Aligarh drain.

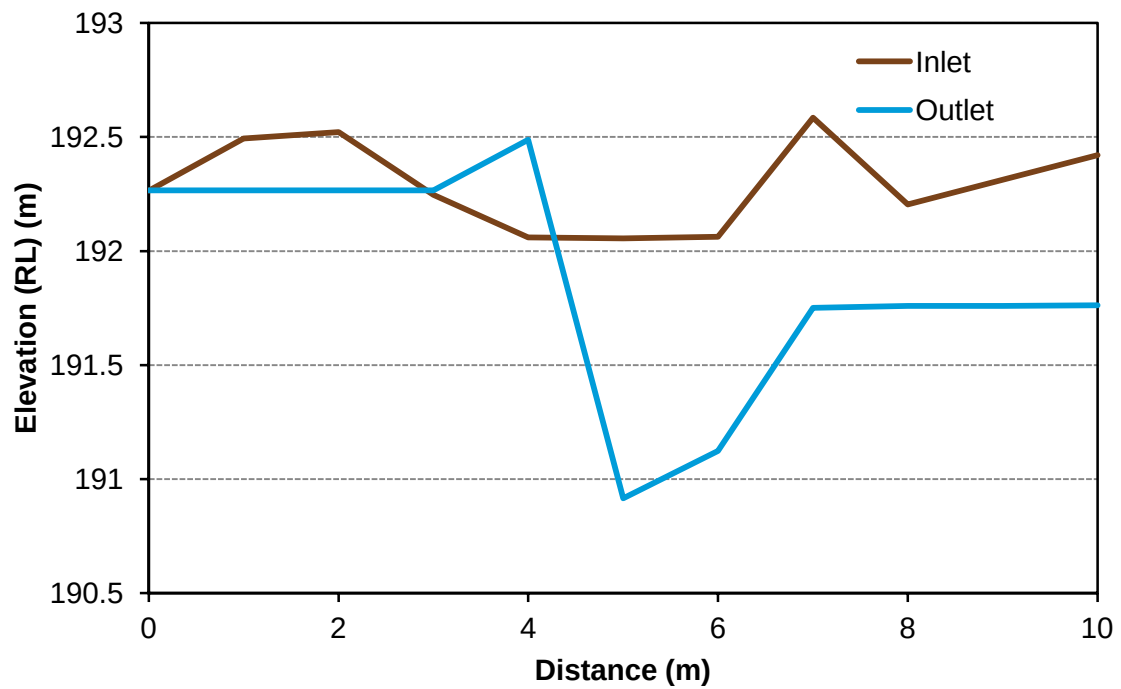


Figure 5.13: Existing cross-section of Aligarh drain at inlet and outlet

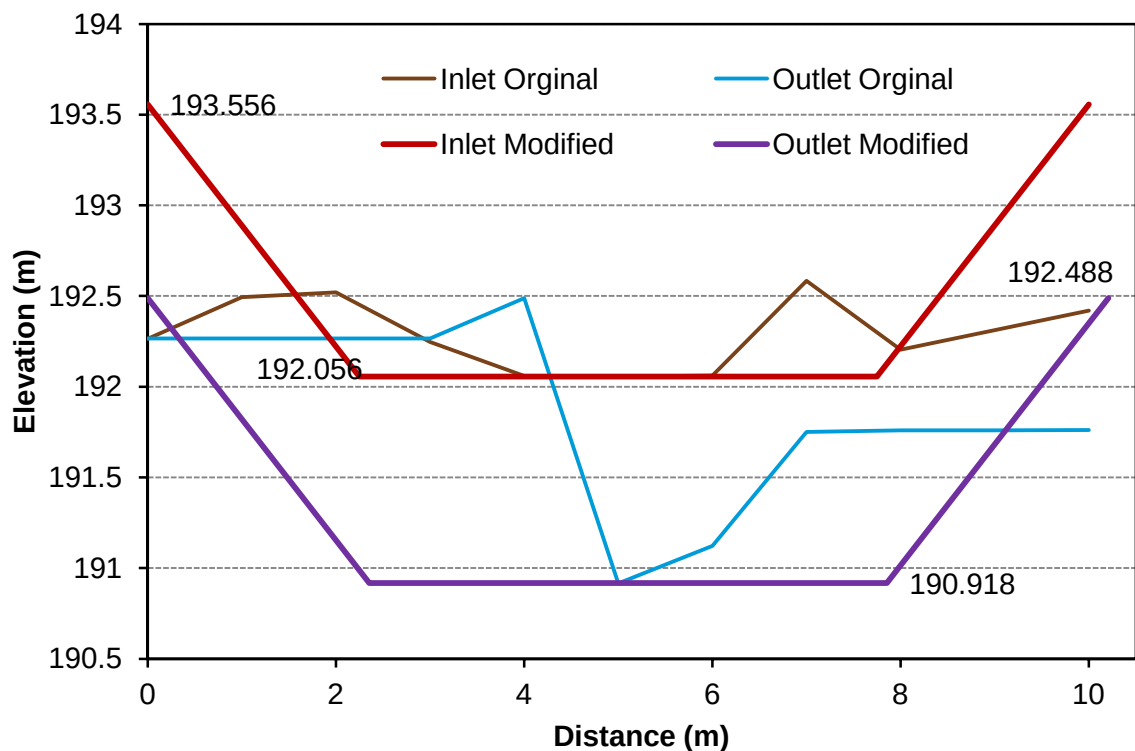


Figure 5.14: Proposed modified drain sections

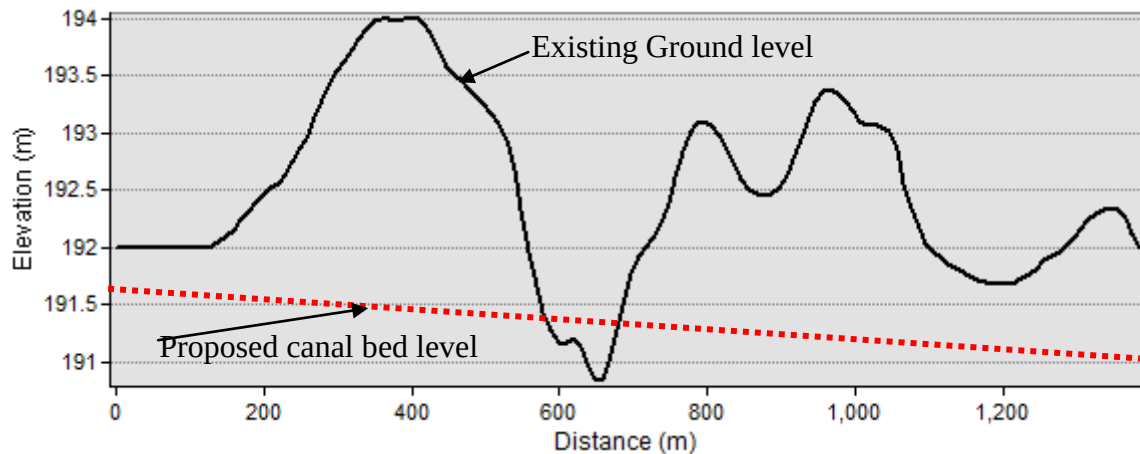


Figure 5.15: Elevation profile along the realigned section of Aligarh drain

5.5.3 Combined flooding due to rainfall and flow through Aligarh drain

To study the effect of local rainfall of various return periods and corresponding flow in the Aligarh drain the Mike-11 setup is coupled with Mike-21 setup of plant area. The Bathymetry of plant area (Figure 5.16) is prepared at 5 m grid size for Mike Flood simulation. The combined effect of flooding due to overflowing of Aligarh drain and 100 year return period rainfall is shown in Figure 5.17. The longitudinal profile of Aligarh drain along with maximum water surface water elevation is shown in Figure 5.18. It may be observed that the overtopping of Aligarh drain is in all sections. However, in some locations the surface levels are higher and there is no flooding (Figure 5.17). Seven grids (cross marked in Figure 5.17) are selected on both sides of drain to view detail time series. The water depth and water levels at these grids are shown in Figure 5.19 and Figure 5.20 respectively. It can be noticed that the maximum water level at most upstream grid attains maximum of 193.3 m and in all other cases the maximum level is below 193.1 m. The water depth for 50, 25 and 10 year return periods are shown in Figure 5.21 to Figure 5.23 respectively. The water levels for various return periods during 48 hour simulation period at the selected seven grid points are shown in Figure 5.24 (a) to (g) and the maximum water levels are given in Table 5.9.

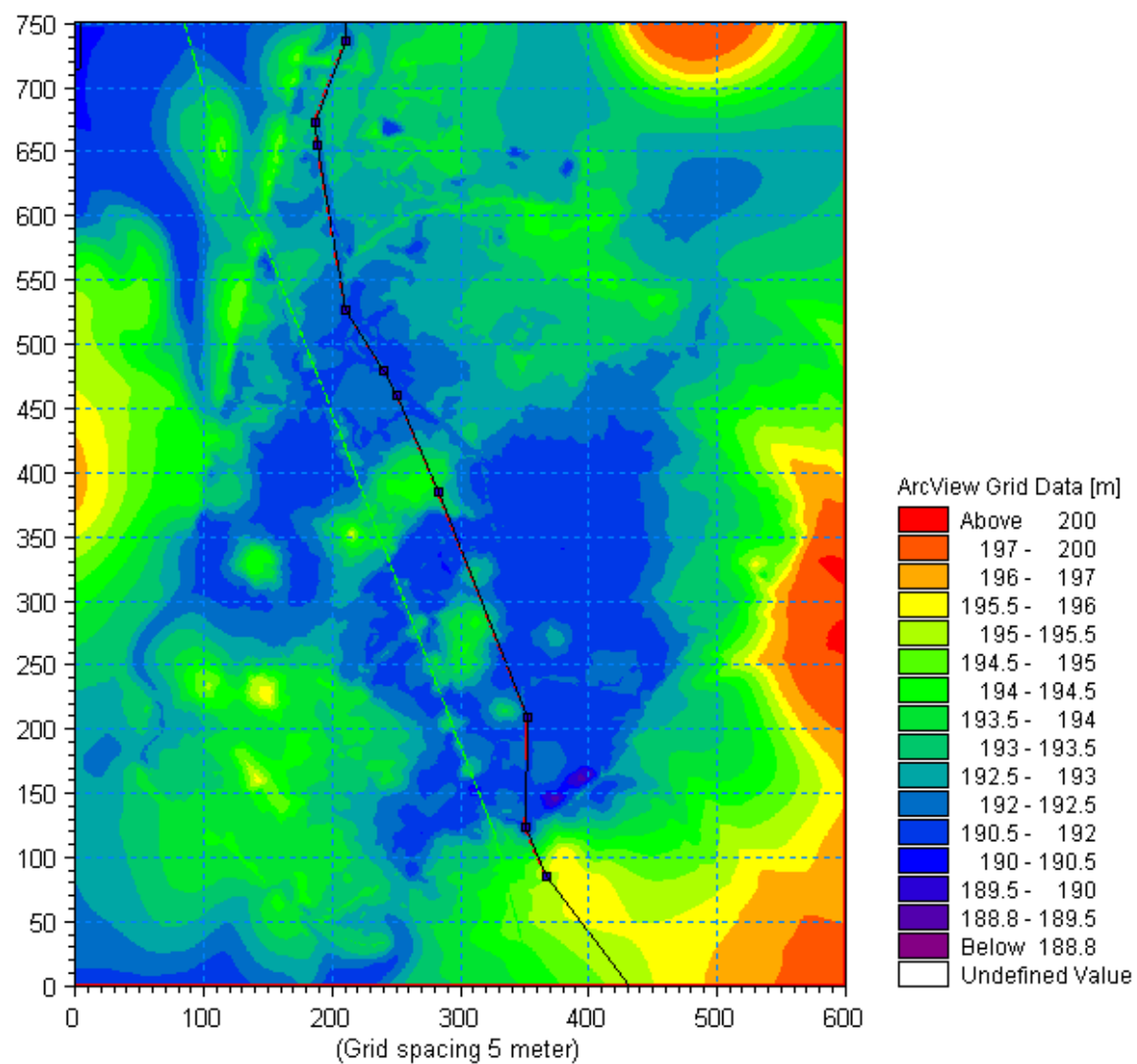


Figure 5.16 Bathymetry of the plant area

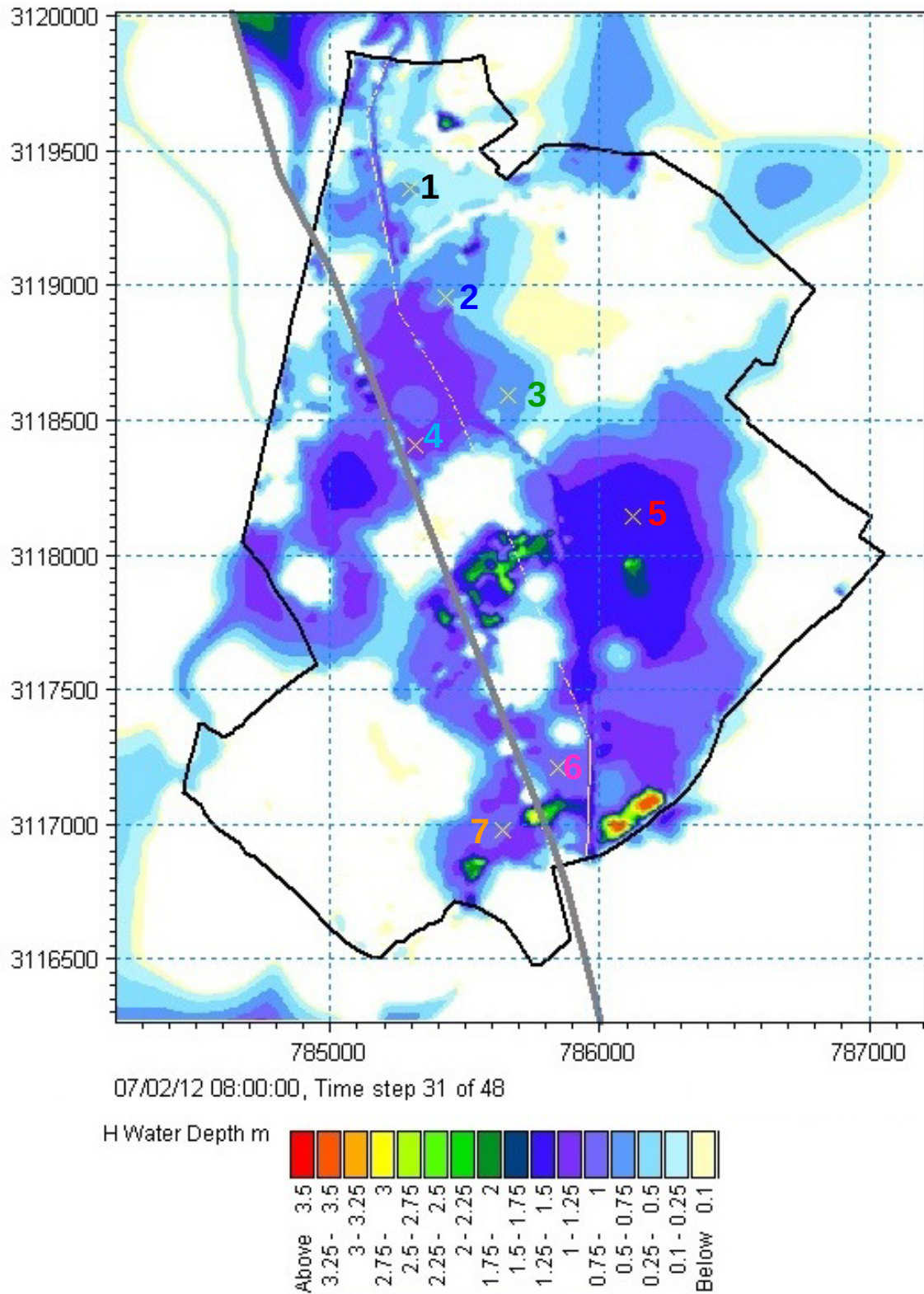


Figure 5.17: Flood water depth due to 100 year return period rainfall.

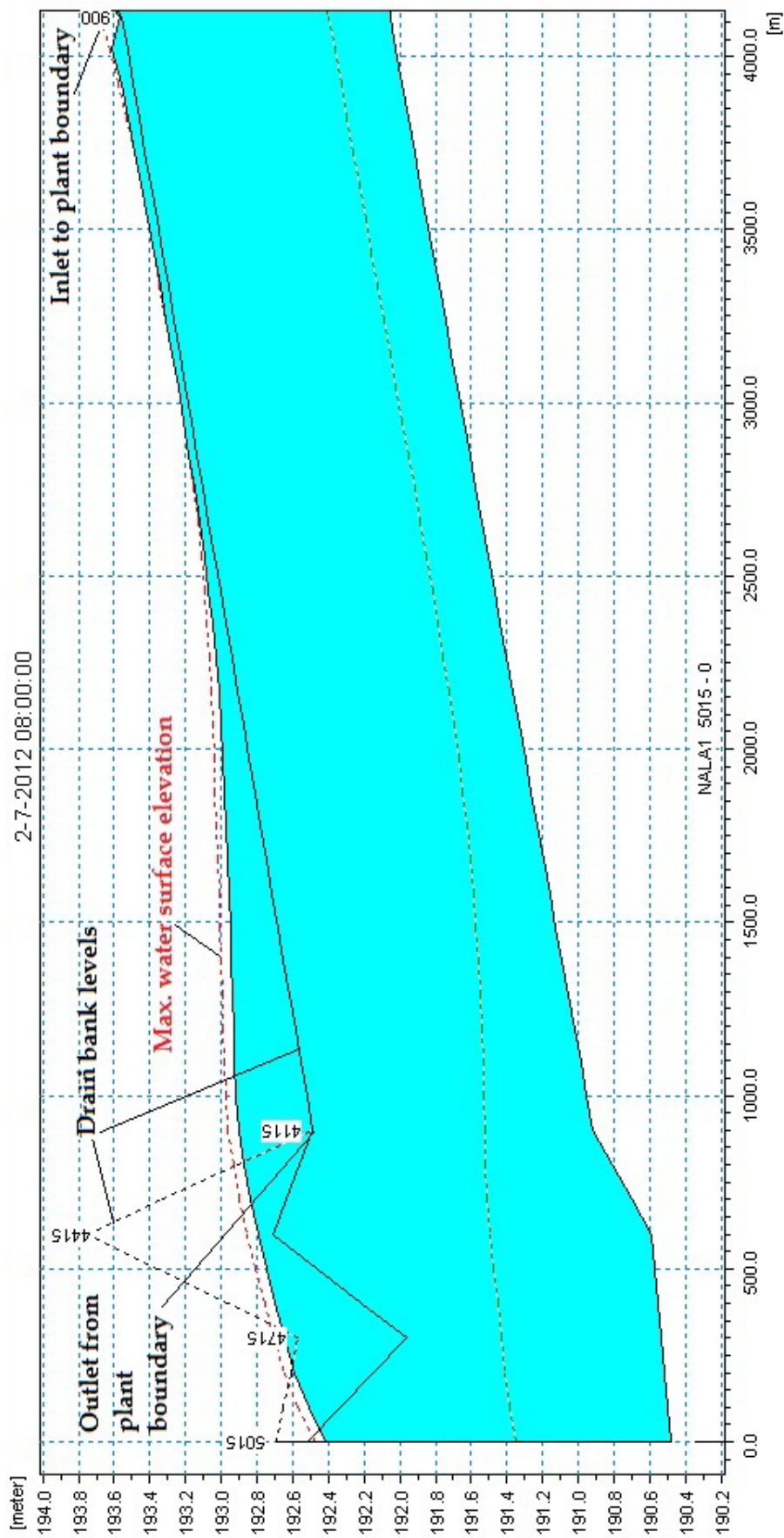


Figure 5.18: Longitudinal profile of modified Aligarh drain

Table 5.8: Details of selected grids

Sl. No.	Location (X,Y)	Elevation RL (m)
1	(218,619)	192.64
2	(244,538)	192.53
3	(291,465)	192.50
4	(222,428)	192.01
5	(383,375)	191.46
6	(328,189)	192.00
7	(287,142)	192.01

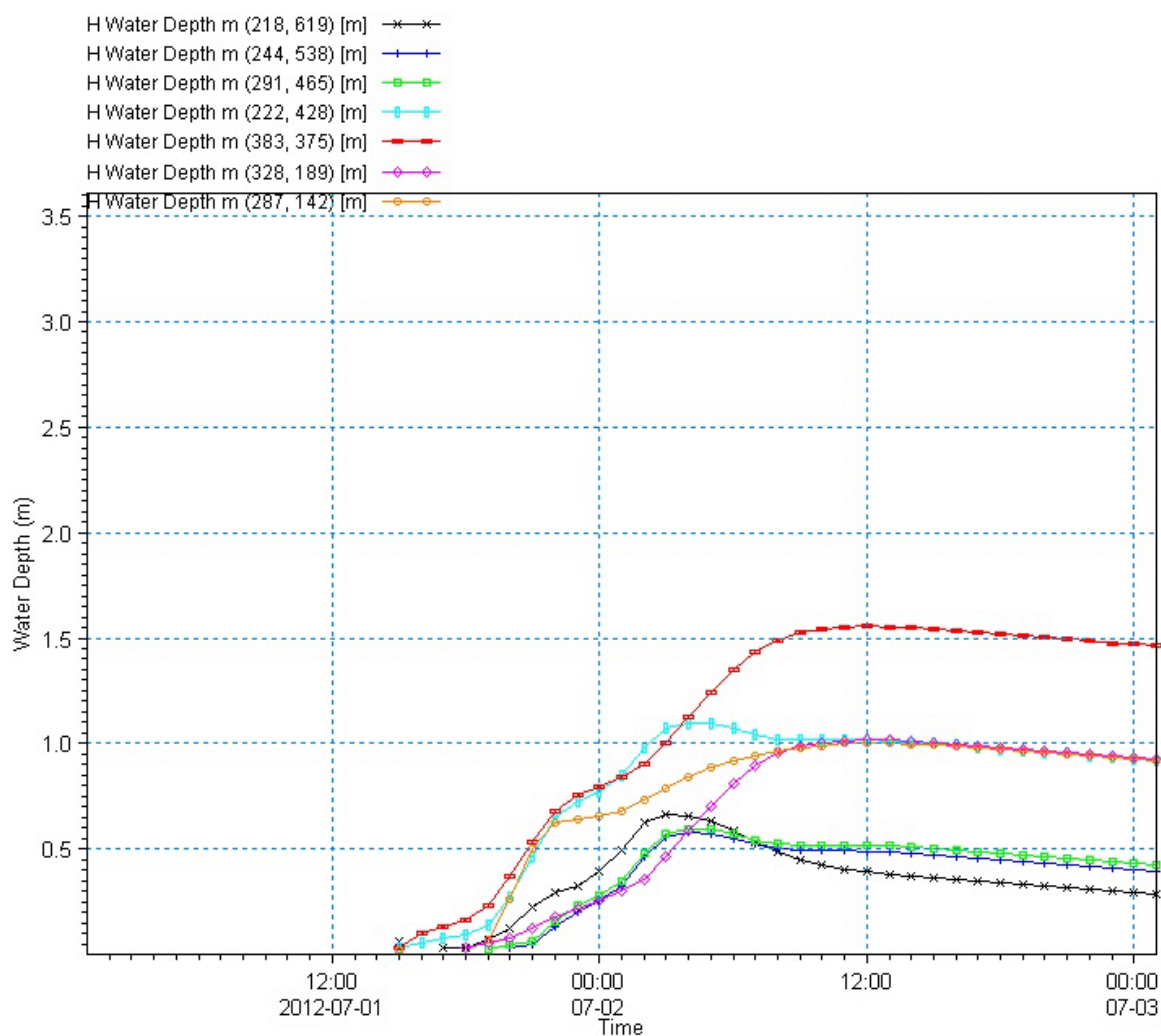


Figure 5.19: Water depths at selected grids for 100 year return period flood

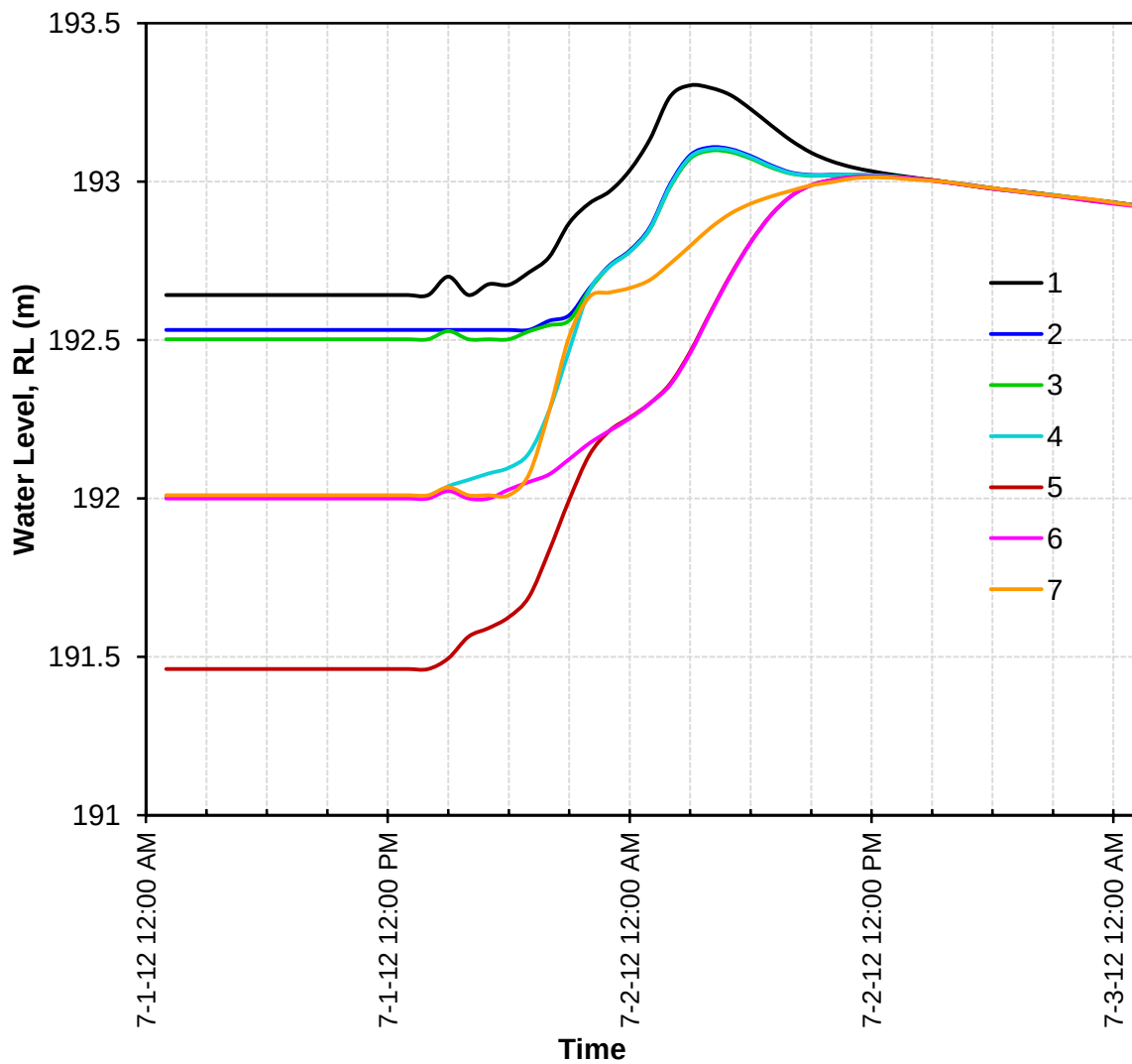


Figure 5.20: Water levels at selected grids for 100 year return period flood

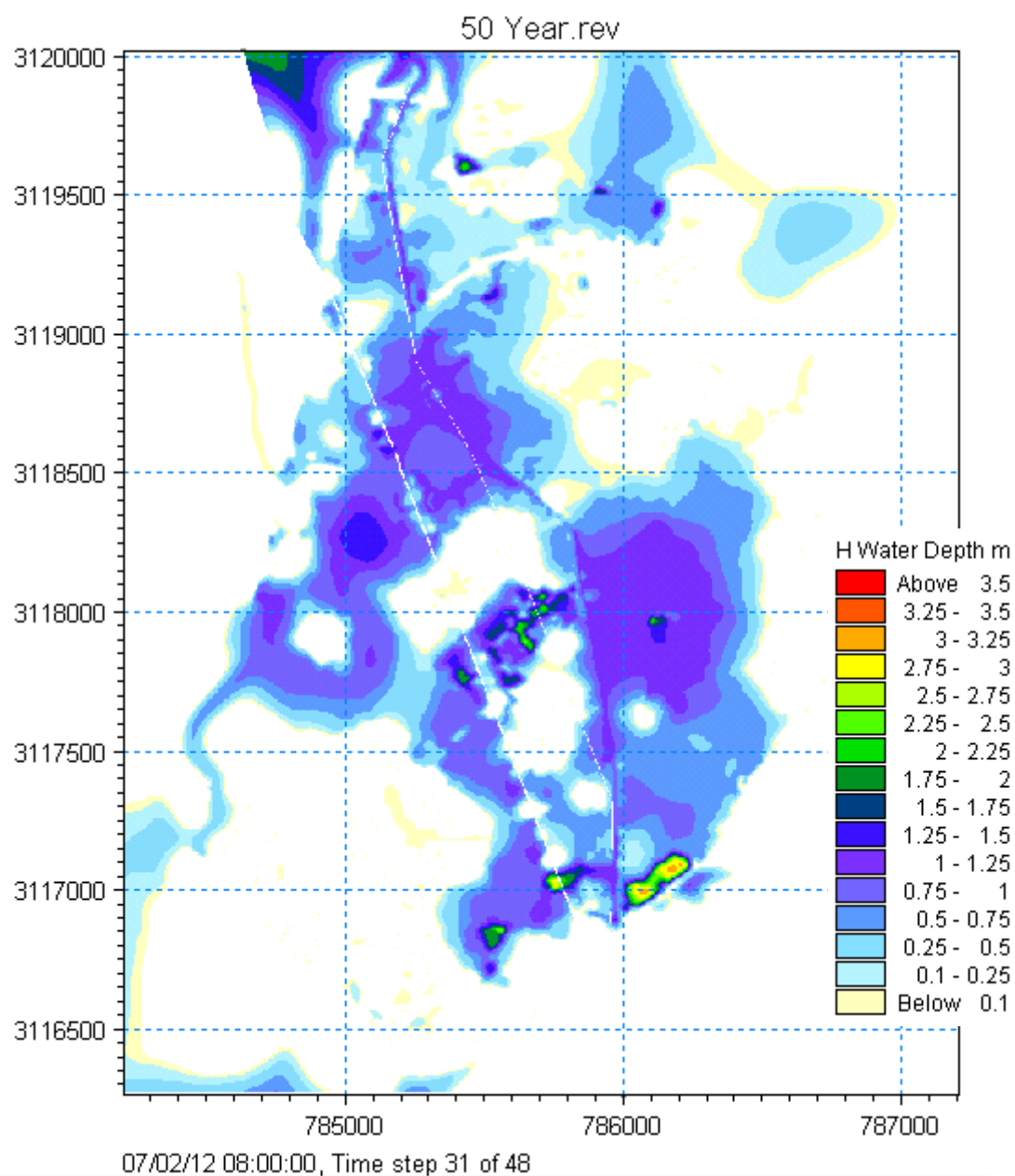


Figure 5.21: Flood water depth due to 50 year return period rainfall

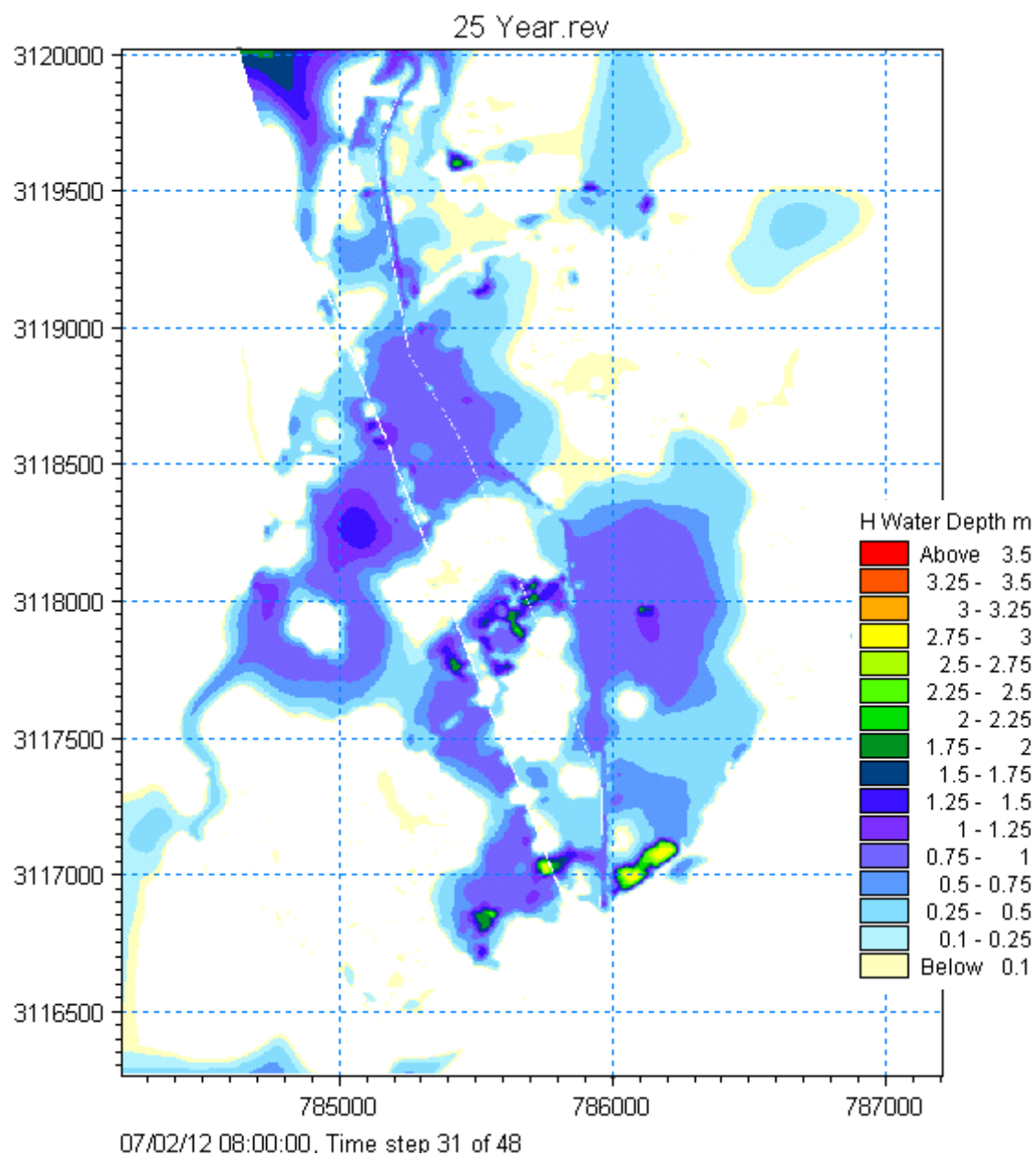


Figure 5.22: Flood water depth due to 25 year return period rainfall

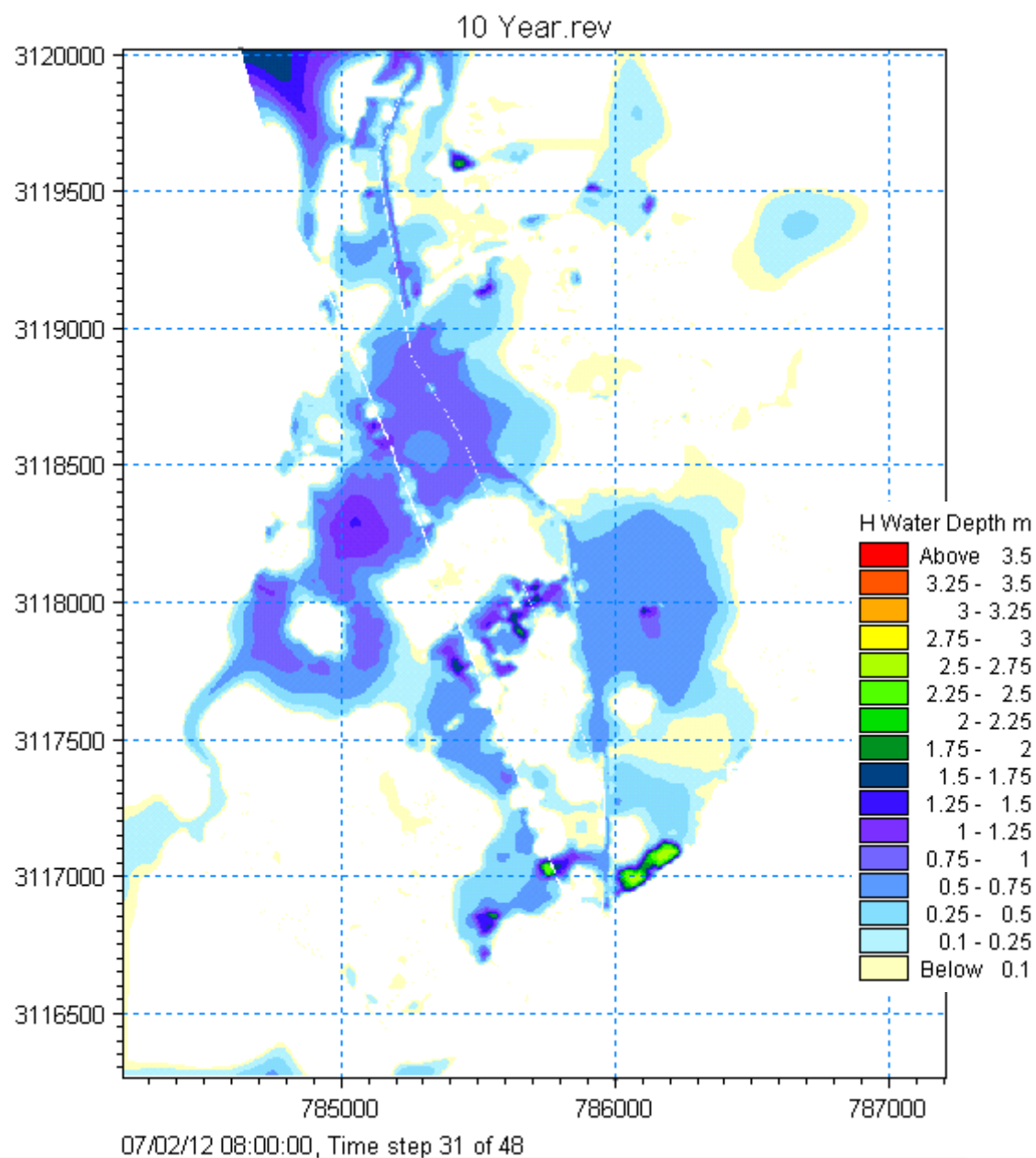
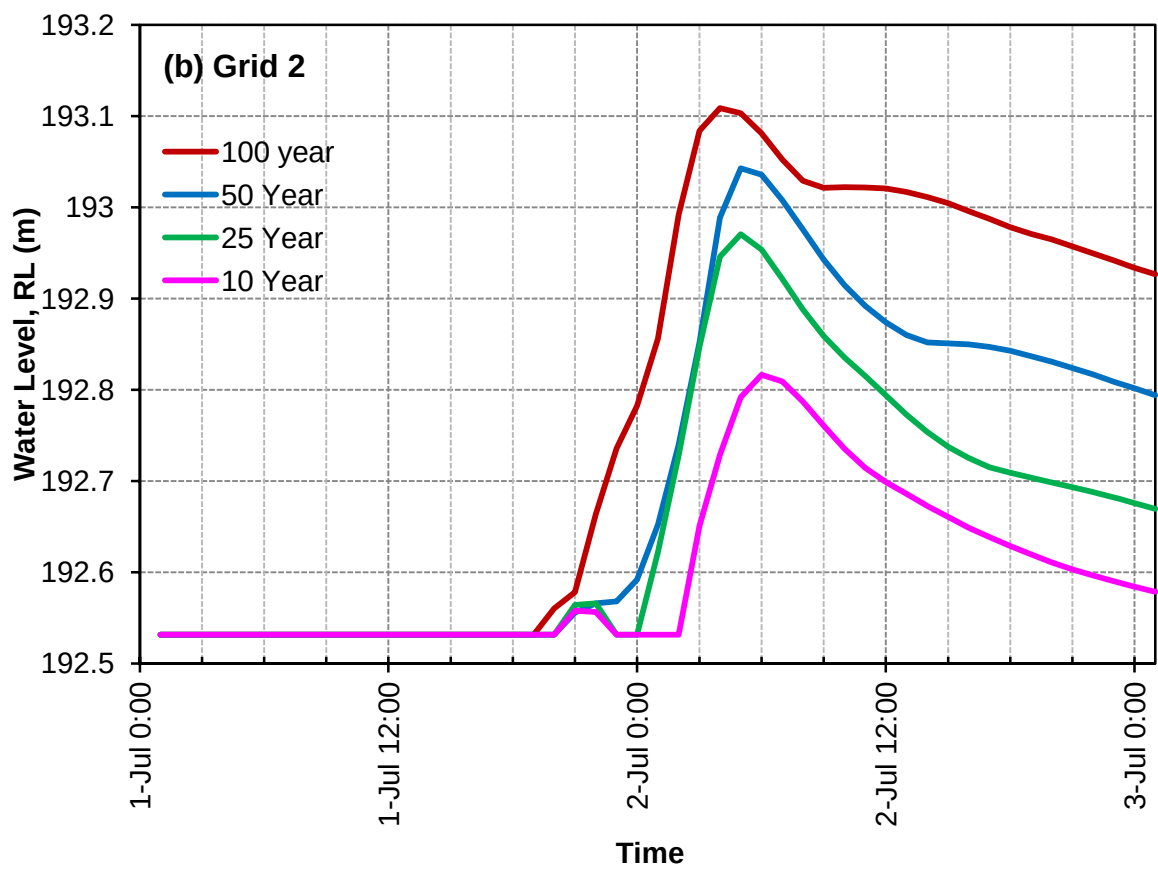
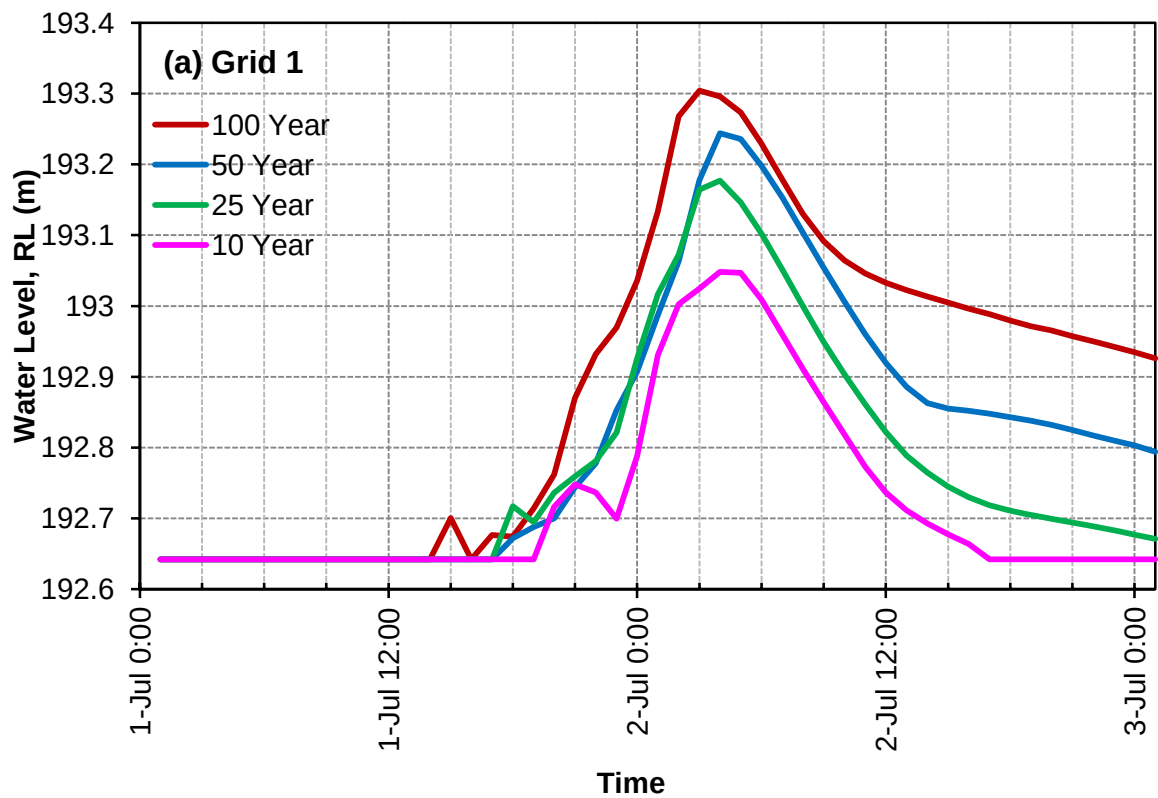
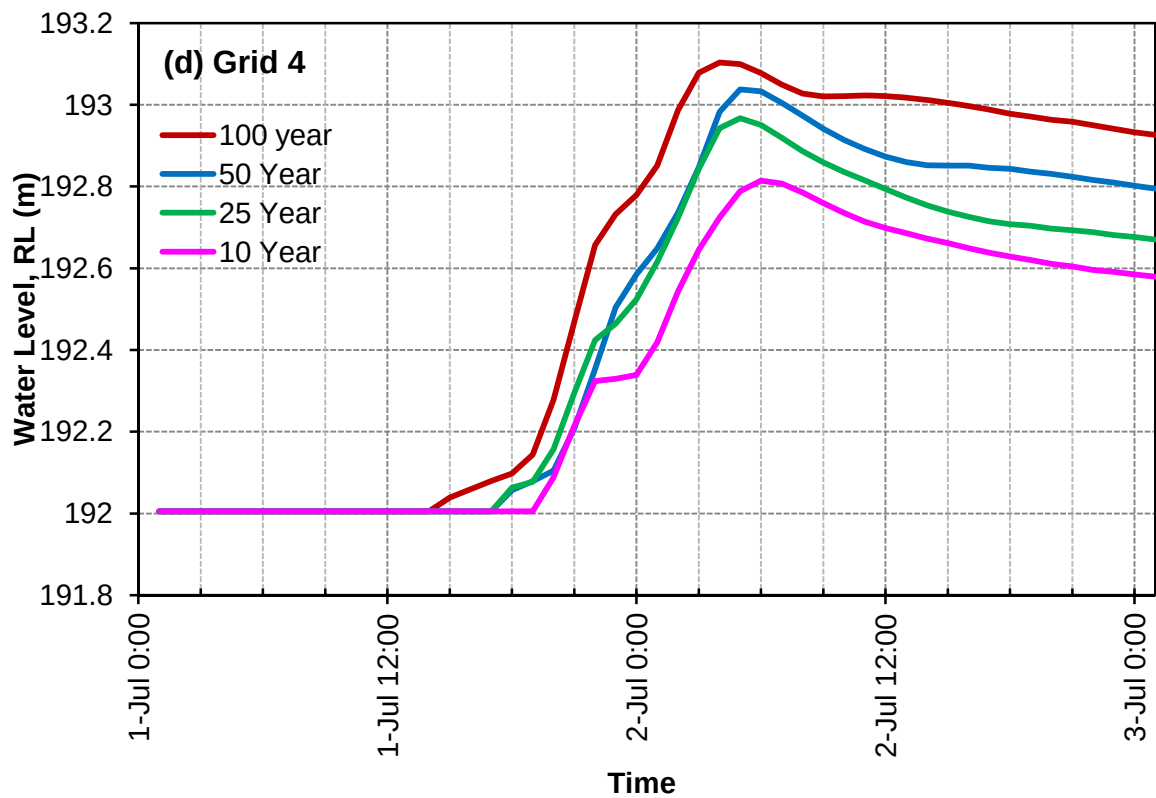
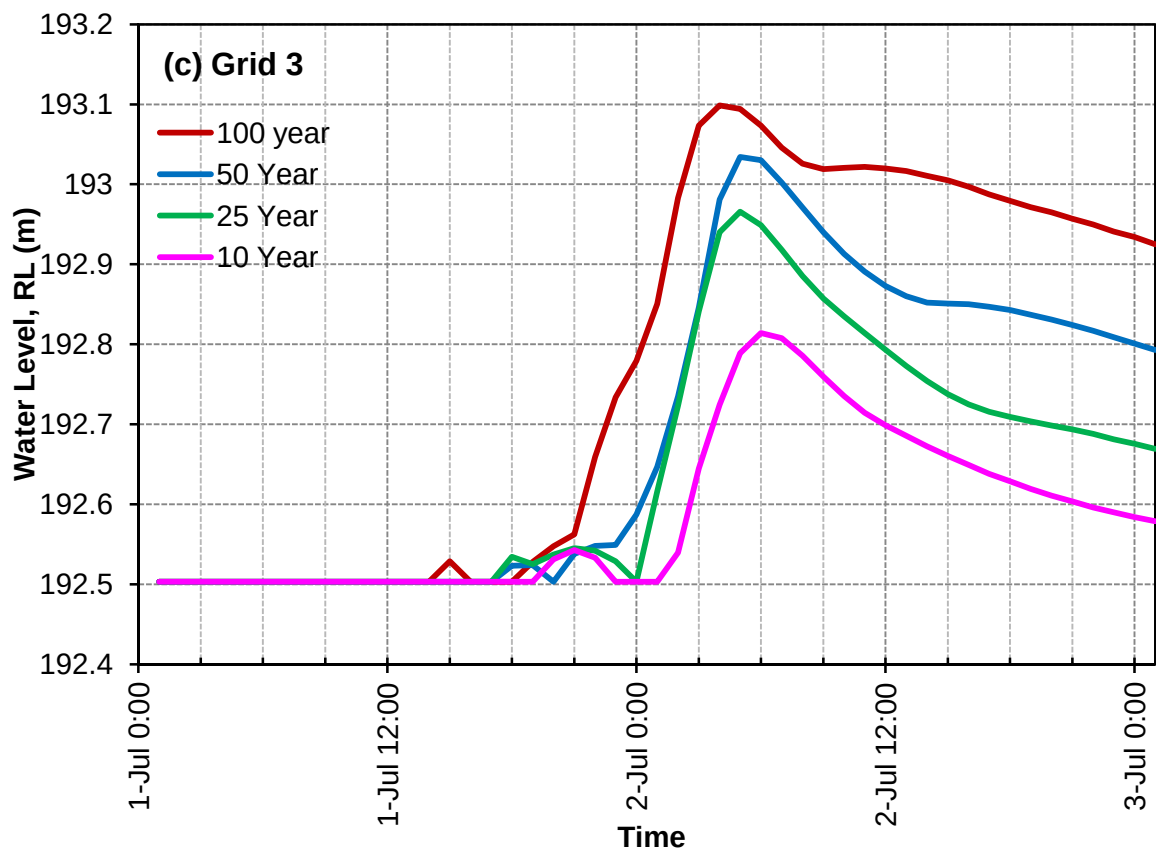
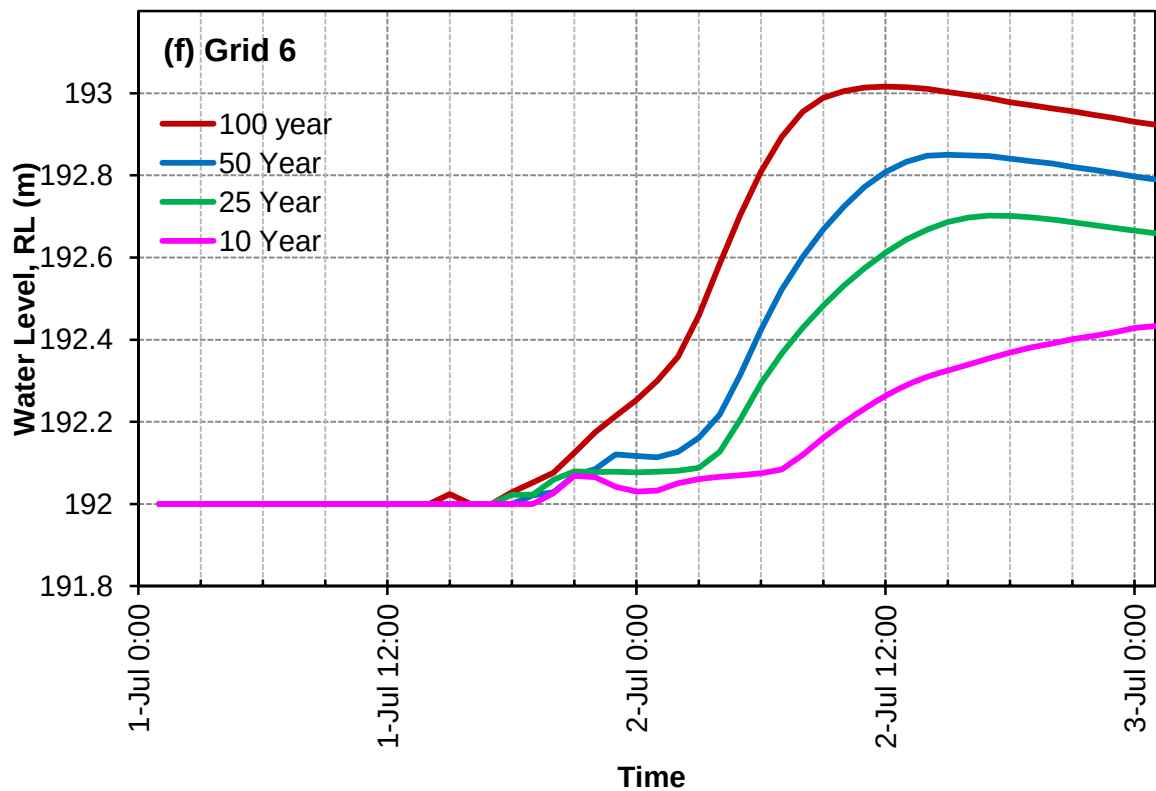
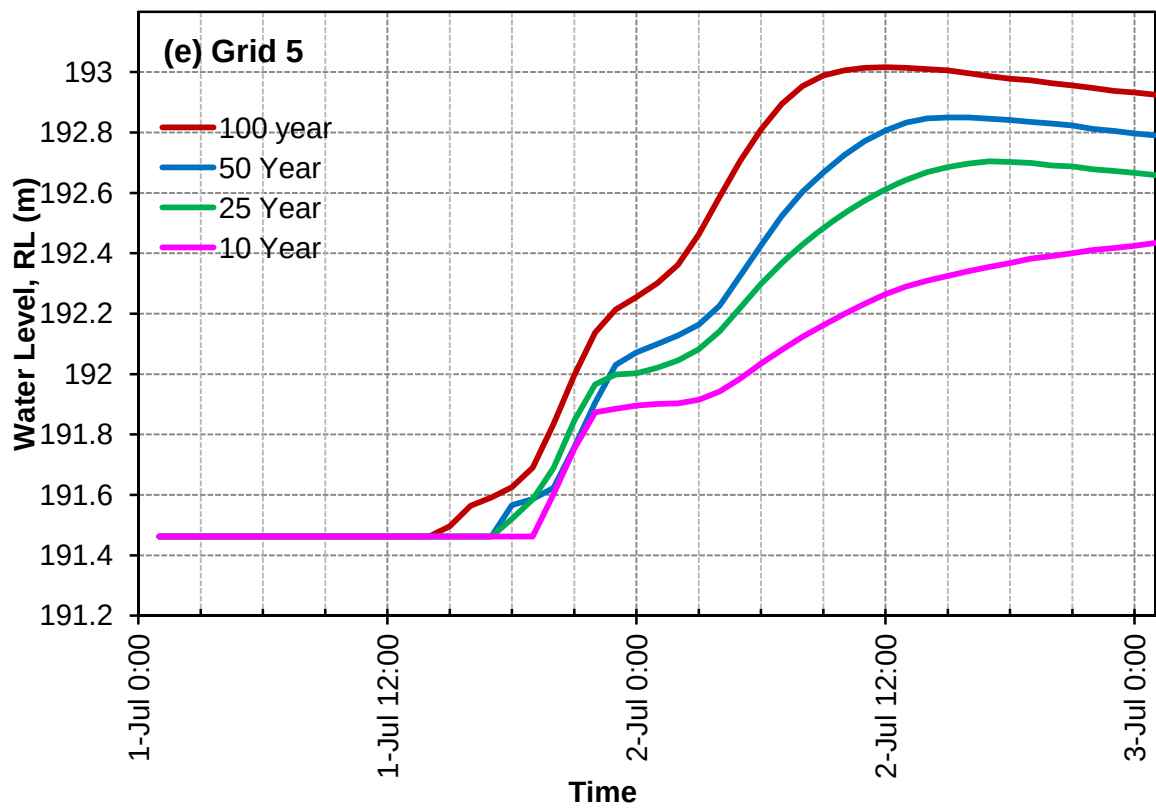


Figure 5.23: Flood water depth due to 10 year return period rainfall







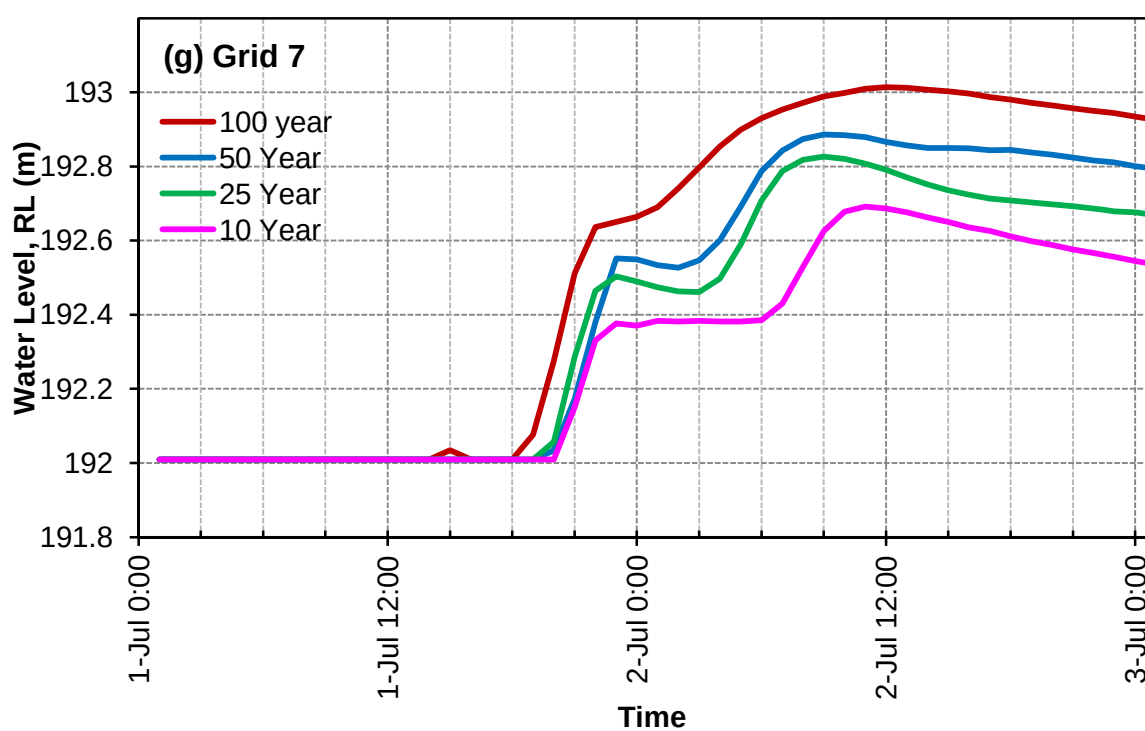


Figure 5.24 : Water levels for various return period flood. (a) to (g) for grid point 1 to 7

Table 5.9 : Maximum water level at selected grids for various return periods

Grid Sl. No.	Maximum water level RL (m)			
	100 Year	50 Year	25 Year	10 Year
1	193.30	193.24	193.18	193.05
2	193.11	193.04	192.97	192.82
3	193.10	193.03	192.97	192.81
4	193.10	193.04	192.97	192.81
5	193.02	192.85	192.70	192.43
6	193.02	192.85	192.70	192.43
7	193.01	192.89	192.83	192.69

5.6 Safe Grade Elevation

As discussed above flooding in the plant area may occur due to local rainfall and overflowing of Aligarh drain. The rainfall generated flow from upper catchment flows through Aligarh drain inside plant boundary. The cross-section of Aligarh drain is modified in 10 m width and realigned as shown in Figure 5.12. However, the modified section is also not able to carry the 100 year discharge and flooding has been observed. Hence, the possible flooding will be due to local rainfall and overflowing of Aligarh drain and needs be considered both in deciding the safe grade. It has been observed that maximum flood depth for this case is not uniform within the plant layout boundary and depending upon topography, it varies from 0.1 m to 1.5 m for 100 year return period rainfall excluding some local depressions. Further, the maximum water level at most upstream grid (Grid 1) reached maximum up to 193.3 m and other grids are below 193.1 m (Table 5.9). The model setup has been prepared with limited data and therefore 0.2 m may be kept extra buffer to cater data and model uncertainty in deciding safe grade elevation. Considering these aspects the safe grade should be higher than 193.5 m (193.3+0.2). In present situation about 20% of total plant area is above 193.5 m (Figure 5.25). The National Disaster Management Authority, Government of India recommends the plinth levels of all the buildings 0.6 m above the drainage/ flood submersion lines (NDMA, 2008). Moreover, the highway is also at a RL of 194.399 m (RP-14 in the Topographical survey of proposed Khurja STPP site). Considering these aspects, it is suggested to have the safe grade level in the plant area should be higher than RL 193.5 m and the the plinth levels should be higher than 194.1m or 194.4 m to avoid any drainage congestion due to highway alignment.

Hence, it is also recommended that the important plant and system installation should be placed at safe flood level of RL 193.5 m while the land development work within the plant site should be carried out to maintain the natural slope to facilitate the drainage in the area and divert any entry of excess water through plant boundary.

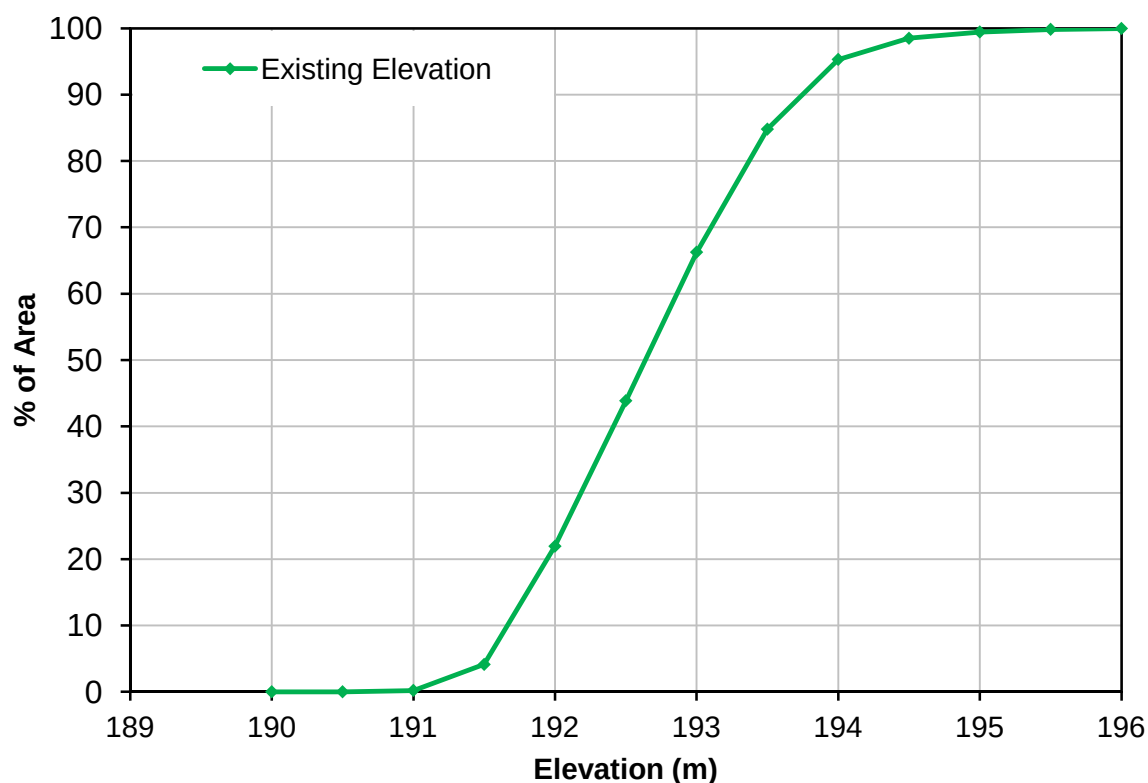


Figure 5.25: Percentage of area in existing levels.

5.7 Proposed Drainage Network

5.7.1 Drainage layout

The proposed local and periphery drains (1 to 13) are aligned along the plant boundary and roads as shown in Figure 5.26. The drains and their possible drainage area are shown in Figure 5.27. The white colour area will drain to directly to the Aligarh drain. The drains are aligned according to the natural slope and existing topography. However, the drain-1 is proposed to divert along plant boundary even though the existing drain joins to Aligarh drain inside the plant area. Similarly, the natural slope of drain-3 area is towards drain-2 and the flow to Aligarh drain inside plant area. However, these drains are also proposed to divert along the plant boundary as suggested by THDCIL. Flow directions in the drains are indicated by arrow. The drainage area of each section is given in Table 5.10. The discharge in drains for various return periods are estimated by multiplying its drainage area with estimated discharge per unit area of the required return period. The drains 1 to 5 runs in series along the east side of plant boundary. The drain 5 is also expected to carry discharge of existing drain joining the Aligarh drain as it will be removed during land development process. Further the drain 13 represents the existing escape/drain for releasing excess flow from the distributary. The length of drain 11 will be less, if the Aligarh drain is realigned. Further drain 10 and 11 cross the highway through culverts and join to Aligarh drain.

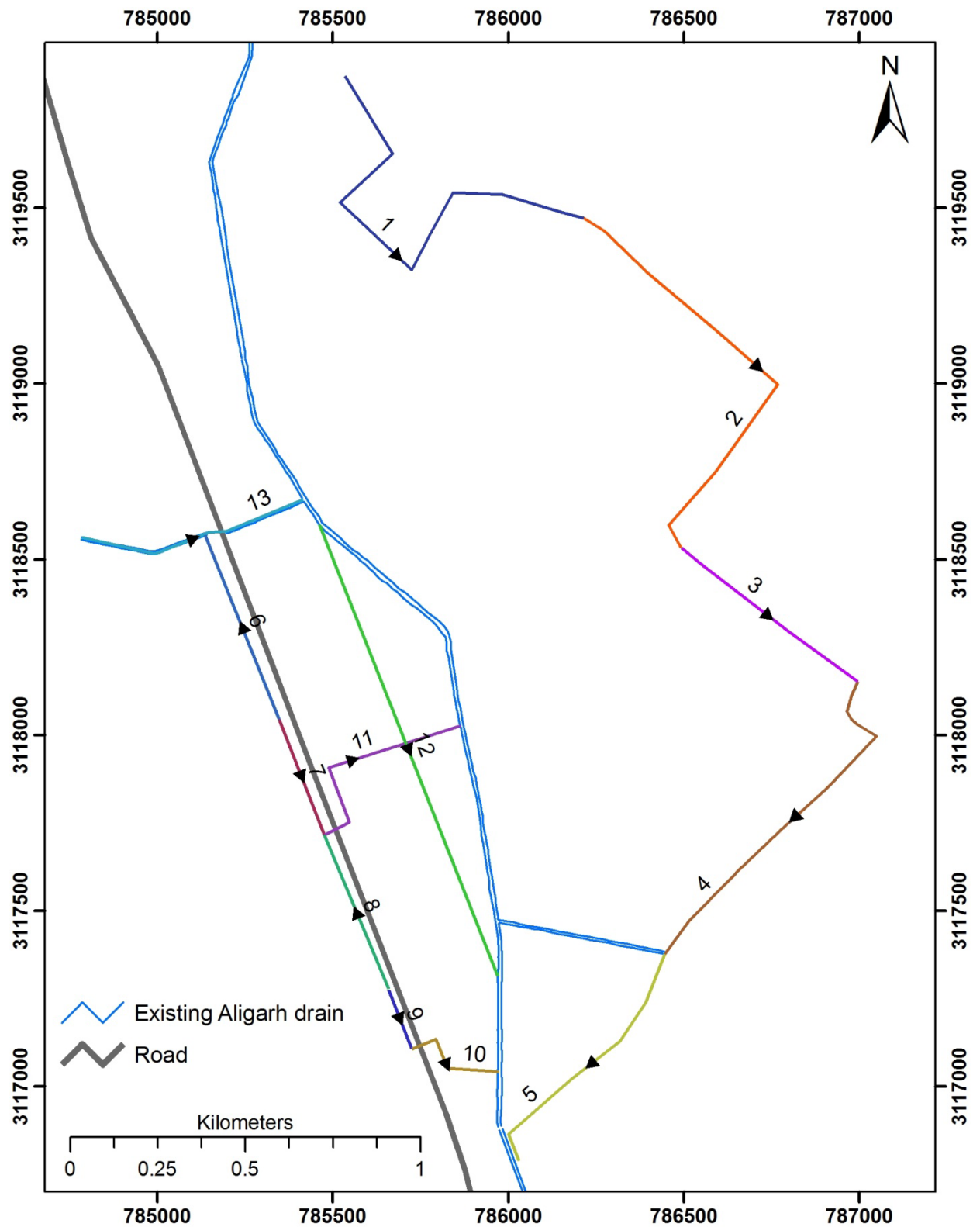


Figure 5.26 : Proposed drainage layout

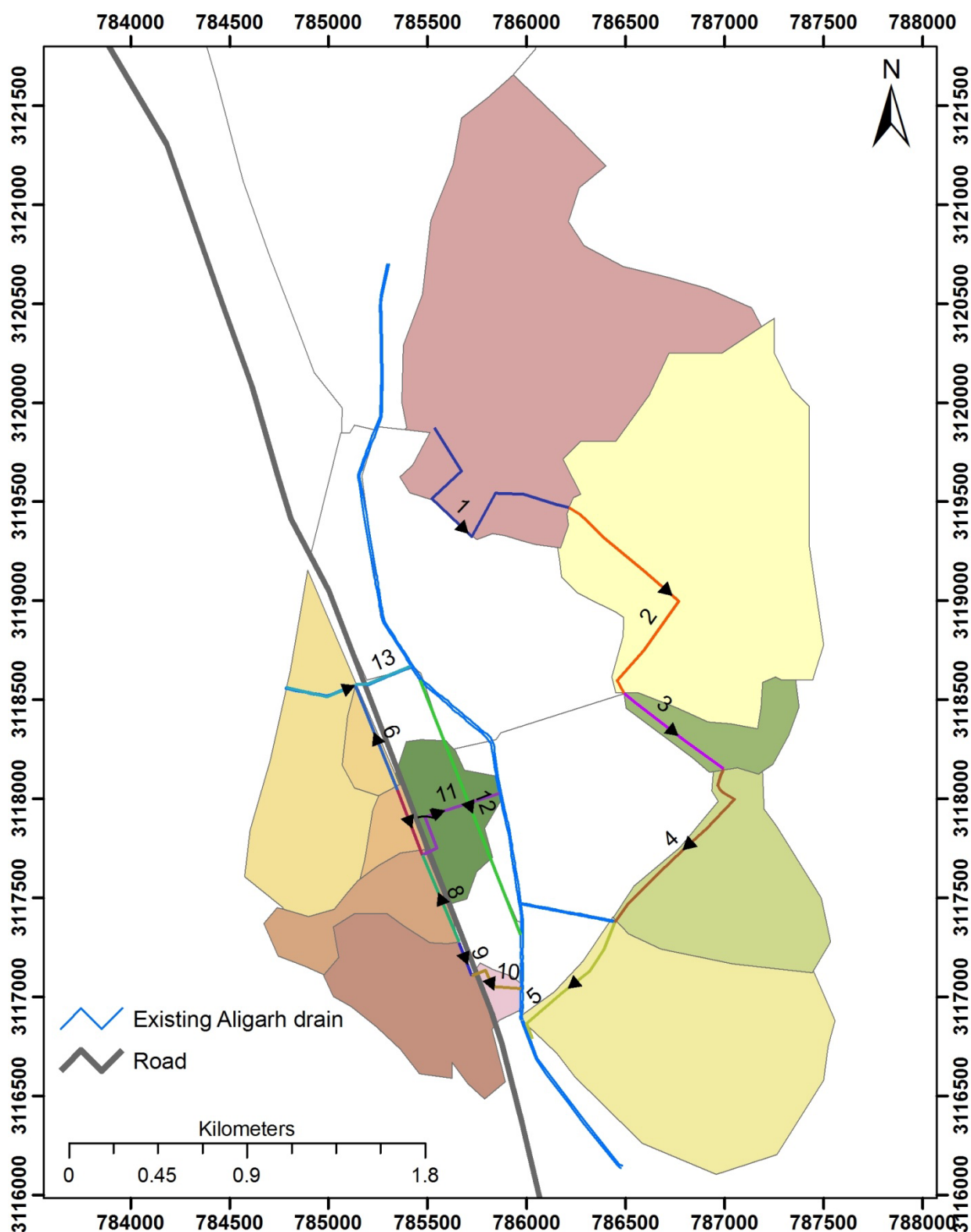


Figure 5.27: Proposed drainage network with contributing runoff area

Table 5.10 Length, drainage area and peak flow of various sections.

Section	Length (m)	Area (km ²)	Peak flow (m ³ /s)			
			Drainage area flow		Cumulative flow	
			25 year	50 year	25 year	50 year
1	1374.56	2.16	12.16	14.73	12.16	14.73
2	1311.61	1.88	10.58	12.82	22.74	27.55
3	630.80	0.20	1.13	1.36	23.87	28.91
4	1071.51	0.64	3.60	4.36	27.47	33.27
5	695.40	1.25	7.04	8.52	34.50	41.79
6	565.09	0.09	0.51	0.61	0.51	0.61
7	354.53	0.08	0.45	0.55	0.45	0.55
8	475.02	0.25	1.41	1.70	1.41	1.70
9	180.04	0.52	2.93	3.55	2.93	3.55
10	308.25	0.52	2.93	3.55	5.85	7.09
11	640.76	0.26	1.46	1.77	3.32	4.02
13	666.75	0.63	3.55	4.30	4.05	4.91

5.7.2 Design of drain section

The cross-section of the drains are designed according the Indian Standard, IS 10430:2000 (BIS, 2006). Trapezoidal section with side slope 1.5:1 (H:V) and longitudinal slope of 0.001 m/m (1.0 m/km) is designed. The longitudinal slope (s) is kept low as the topography of area is very flat. The drain sections are designed for velocity less than 2 m/s and Manning's roughness coefficient (n) values of 0.015 (lined section). The Free board recommended in the standard and used in this study is 0.6 m for discharge less than 10 m³/s and 0.75 for higher discharge value. The design details of various drain sections for 50 year and 25 year return period are given in Table 5.11. The drain 13 represents existing escape drain. The calculated dimension may be less as it doesn't account for possible amount of discharge from the minor irrigation channel. Further, section 5 supposed to carry additional discharge diverted to it. Hence, to account for this additional discharge, the drain section needs modification..

Table 5.11 Design details of drain section for 50 year and 25 year return period

50 year return period

Drain Section	Q	b	d	v	z	fb	D	t	T
1	14.73	2.0	1.7	2.0	1.5:1	0.75	2.4	7.0	9.2
2	27.55	2.9	2.0	2.3	1.5:1	0.75	2.8	8.9	11.2
3	28.91	3.0	2.0	2.3	1.5:1	0.75	2.8	9.0	11.3
4	33.27	3.0	2.2	2.4	1.5:1	0.75	3.0	9.6	11.9
5	41.79	4.0	2.2	2.5	1.5:1	0.75	3.0	10.6	12.9
6	0.61	0.5	0.6	1.0	1	0.6	1.2	1.7	2.9
7	0.55	0.5	0.5	1.0	1	0.6	1.1	1.5	2.7
8	1.70	1.0	0.8	1.2	1	0.6	1.4	2.6	3.8
9	3.55	1.0	1.0	1.4	1.5:1	0.6	1.6	4.0	5.8
10	7.09	2.0	1.2	1.7	1.5:1	0.6	1.8	5.6	7.4
11	4.02	1.0	1.1	1.5	1.5:1	0.6	1.7	4.3	6.1
13	4.91	1.0	1.1	1.5	1.5:1	0.6	1.7	4.3	6.1
25 year return period									
1	12.16	2.0	1.5	1.9	1.5:1	0.75	2.3	6.5	8.8
2	22.74	2.9	1.8	2.2	1.5:1	0.75	2.6	8.3	10.6
3	23.87	2.9	1.9	2.2	1.5:1	0.75	2.7	8.6	10.9
4	27.47	3.0	2.0	2.3	1.5:1	0.75	2.8	9.0	11.3
5	34.50	3.5	2.1	2.4	1.5:1	0.75	2.9	9.8	12.1
6	0.51	0.5	0.6	0.8	1	0.6	1.2	1.7	2.9
7	0.45	0.5	0.5	0.9	1	0.6	1.1	1.5	2.7
8	1.41	1.0	0.7	1.2	1	0.6	1.3	2.4	3.6
9	2.93	0.8	1.0	1.4	1.5:1	0.6	1.6	3.8	5.6
10	5.85	2.0	1.0	1.5	1.5:1	0.6	1.6	5.0	6.8
11	3.32	1.0	1.0	1.4	1.5:1	0.6	1.6	4.0	5.8
13	4.05	1.0	1.1	1.5	1.5:1	0.6	1.7	4.3	6.1

*Q = Design discharge (m³/s)**b = Bed width (m)**d = Depth without free board (m)**v = Velocity (m/s)**z = Side slope (H:V)**fb = Free board (m)**D = Depth with free board (m)**t = Top width without free board (m)**T = Top width with free board (m)*

5.8 Limitation of the Study

The limitation of the study due to non availability of data and assumption in the model are as follows:

1. The contour of 0.5 m interval was only available for the proposed plant area. For the remaining area SOI contour and SRTM data is used.
2. The available observed hourly rainfall data was sufficient to generate hourly rainfall distribution curve, hence the time distribution of rainfall was done according to CWC (1984) report.
3. Drain alignments are made with exiting topography. This may be modified according to final level obtained after land levelling.

6 CONCLUSIONS

Based on study following conclusions are drawn:

- 1 The Digital Elevation Model (DEM) of the study area is prepared from surveyed contour (0.5 m) for the plant area, spot heights; contour digitized from the SOI toposheets and SRTM data. The basin boundary and drainage networks are delineated manually from the DEM and SOI toposheets inside ArcGIS.
- 2 The catchment area of Aligarh drain up to proposed plant boundary, its length and slope are used to derive unit hydrograph using the guideline provided by CWC.
- 3 The 1-day annual maximum rainfall for various return periods are estimated for the site Aligarh, Bulandshahr, Khurja by rainfall frequency analysis using L-moments approach. Similarly the regional 1-day annual maximum rainfall for various return periods are also estimated.
- 4 The regional L-moments based approach resulted in maximum rainfall value based on the data of three stations for 100 year return period rainfall. Hence, regional 1-day annual maximum rainfalls for 100 year return period is used for design flood estimation and drain design. The regional rainfall estimated using the rainfall data of three rain gauge stations are 20.71 cm, 24.65 cm and 28.99 cm respectively for 25, 50 and 100 year return periods respectively.
- 5 The Peak discharge (m^3/s) in Aligarh drain for 2, 10, 25, 50 and 100 year return periods are found to be 20.13 m^3/s , 44.06 m^3/s , 59.1 m^3/s , 71.59 m^3/s and 85.88 m^3/s respectively from its catchment area of 10.5 km^2 .
- 6 It is observed that the existing cross-section of Aligarh drain is unable to carry design discharge. Hence, modified lined trapezoidal cross-sections is proposed. Moreover, possible re-alignment of Aligarh drain is also proposed. However, the width is limited to 10 m and overflow has been allowed.
- 7 The potential source of flooding at the plant site is due to the local rainfall and overflow from the Aligarh drain also.

- 8 The land formation level should be based on the computed maximum flood elevation for severe most flooding scenario (100 year return period), model uncertainty and limitation of data availability. Considering these aspects, it is suggested to have the safe grade level in the plant area higher than RL 193.5 m and the plinth levels should be higher than 194.1 m or 194.4 m to avoid any drainage congestion due to highway alignment. The land development work within the plant site should be carried out to maintain the natural slope to facilitate the drainage in the area and divert any entry of excess water through plant boundary.
- 9 The peak flow for 25 and 50 year return period rainfall is estimated for various local and periphery drain sections and the trapezoidal drains are designed using Mannings formula and free board is provided as per BIS standard *IS 10430-2000*.
- 10 The local and periphery drains are designed for trapezoidal section with a side slope of 1.5:1 (H:V) and longitudinal slope of 0.001 m/m (1.0 m/km) to carry the discharge generated locally. Moreover, the drain sections are designed for velocity less than 2 m/s and Manning's roughness coefficient (n) values of 0.015.

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Annexure-I

Terms and Conditions:

1 Scope of Work:

- i. Study of existing natural drainage pattern/system, available information in the form of reports, literature, satellite imageries, etc. having a bearing on the storm water drainage system for proposed project and its adjoining areas. The study shall include review of topographical features of the proposed site for the Power Project and its surrounding area.
- ii. Review and analysis of rainfall information to arrive at design storm scenarios.
- iii. Review and analysis of relevant Survey of India Topographical sheets, topographical survey and satellite imageries.
- iv. Estimation of flood hydrographs considering historical as well as design rainfall to suggest complete scheme for storm water drainage of project and its adjoining areas including diversion of existing nalas/streams, if any. In case short interval observed rainfall runoff data would not be available then the standard regional approaches will be used for design flood estimation.
- v. Estimation and routing of design flood hydrograph through the drainage system of concerned catchments considering appropriate boundary conditions including pre-project scenario as well as post-project scenario for suggesting Safe Grade Elevation for the plant.
- vi. Suggesting final disposal point for the storm water & plant drainage.
- vii. Site visit for acquaintance of prevailing conditions and collection of available data at site.
- viii. Visit to THDC office for discussions regarding the studies.

Annexure-II

Annual 1 day maximum rainfall (mm) at various stations

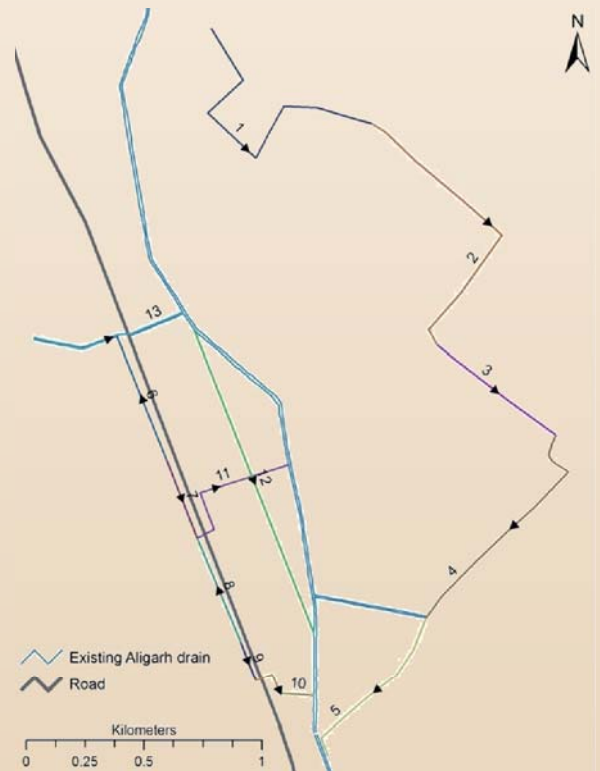
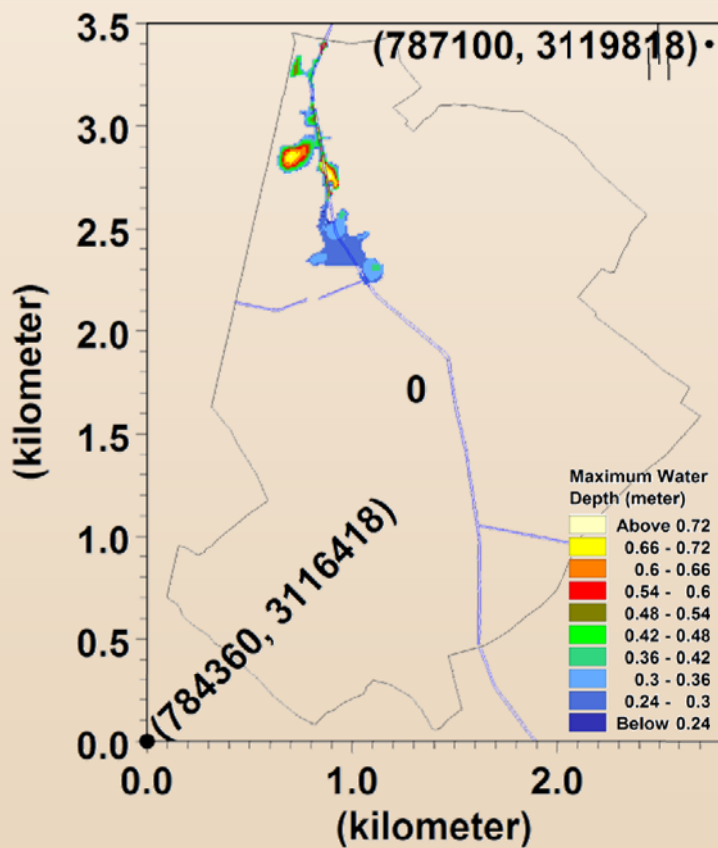
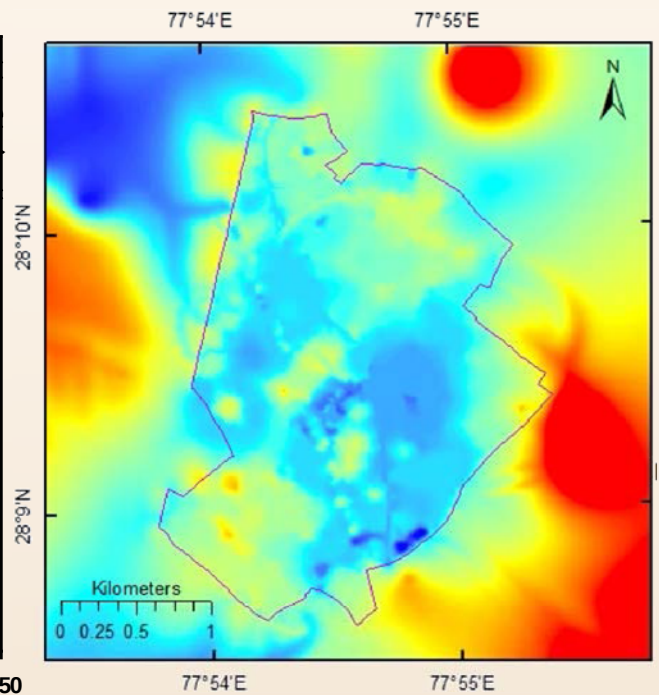
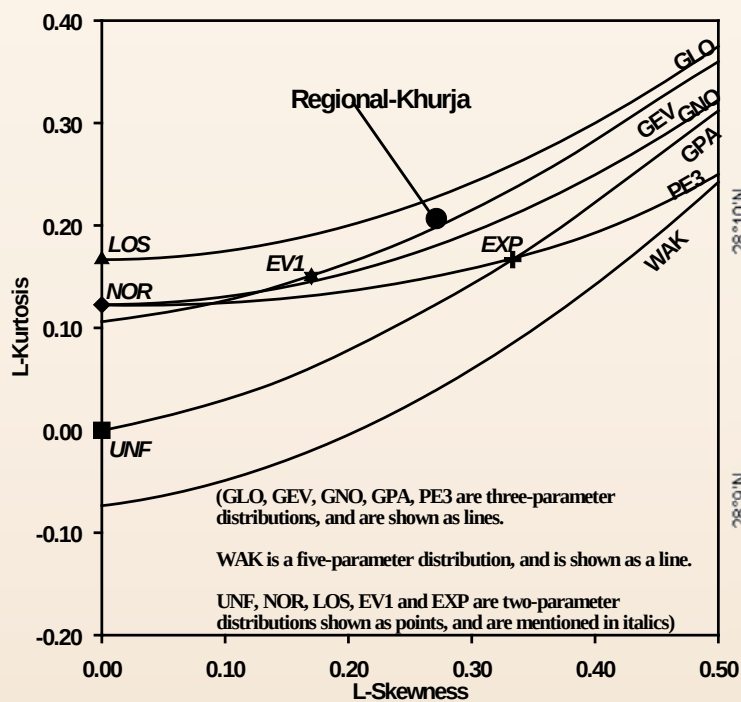
Year	Aligarh Obsy	Bulandshahr Obsy	Khurja	Year	Aligarh Obsy	Bulandshahr Obsy	Khurja
1951	69.3		73.7	1981	327.2	220.0	50.8
1952	52.1		112.0	1982	94.0	81.0	47.0
1953	70.6		81.5	1983	177.8		
1954	115.6		157.0	1984	84.6		
1955	140.0		109.5	1985	73.0		44.5
1956	94.5		111.5	1986	85.2		174.0
1957	155.7		279.4	1987	43.4		129.0
1958	146.3		134.6	1988	121.0		69.0
1959	62.8		127.0	1989	64.0		85.0
1960	90.6		157.7	1990	59.0		46.0
1961	95.6		88.1	1991	143.4		98.5
1962	80.8		71.6	1992	63.2		80.0
1963	144.4		164.3	1993			37.0
1964	220.6		150.9	1994	91.2		92.0
1965	108.2		90.2	1995	81.2		29.0
1966	98.2		39.1	1996	85.4		35.0
1967	124.0		71.1	1997	76.0		38.0
1968	83.0		73.1	1998			48.0
1969	52.0		69.8	1999	47.8		52.5
1970	68.4	72.0	69.8	2000	90.0		33.0
1971	124.8	137.4	129.5	2001	41.0		14.5
1972	117.2	142.8	93.8	2002	90.0		26.0
1973	75.4	92.0	63.0	2003	134.0		100.0
1974	69.7	173.5		2004	63.0		55.0
1975	102.6	178.8		2005	59.6		75.0
1976	84.2	75.9	70.9	2006	88.0		36.5
1977	92.1	54.0	100.3	2007			27.0
1978	76.8	102.0		2008			64.0
1979	62.4	56.8		2009			39.0
1980	62.4	84.2	97.1				

Annexure-III

Ordinate of flood hydrographs due to annual 1 day maximum rainfall for various return periods

Time (h)	100 Year	50 Year	25 Year	10 Year	2 Year
0	0.53	0.53	0.53	0.53	0.53
1	0.53	0.53	0.53	0.53	0.53
2	0.53	0.53	0.53	0.53	0.53
3	0.53	0.53	0.53	0.53	0.53
4	0.56	0.53	0.53	0.53	0.53
5	0.65	0.54	0.53	0.53	0.53
6	0.85	0.56	0.53	0.53	0.53
7	1.24	0.64	0.53	0.53	0.53
8	1.77	0.80	0.56	0.53	0.53
9	2.35	1.05	0.63	0.54	0.53
10	2.96	1.37	0.80	0.55	0.53
11	3.70	1.76	1.10	0.57	0.53
12	4.39	2.29	1.46	0.59	0.53
13	4.94	2.81	1.75	0.64	0.53
14	5.20	3.23	1.93	0.77	0.53
15	5.67	3.44	2.36	1.13	0.53
16	7.19	3.89	3.46	1.92	0.53
17	9.70	5.20	5.17	3.04	0.56
18	12.60	7.30	7.09	4.32	0.66
19	15.66	9.69	9.18	5.78	0.98
20	20.32	12.24	12.42	8.18	1.90
21	28.21	16.16	18.02	12.43	3.89
22	40.53	22.85	26.77	19.14	7.24
23	57.98	33.30	39.20	28.72	12.16
24	76.77	48.13	52.59	39.04	17.52

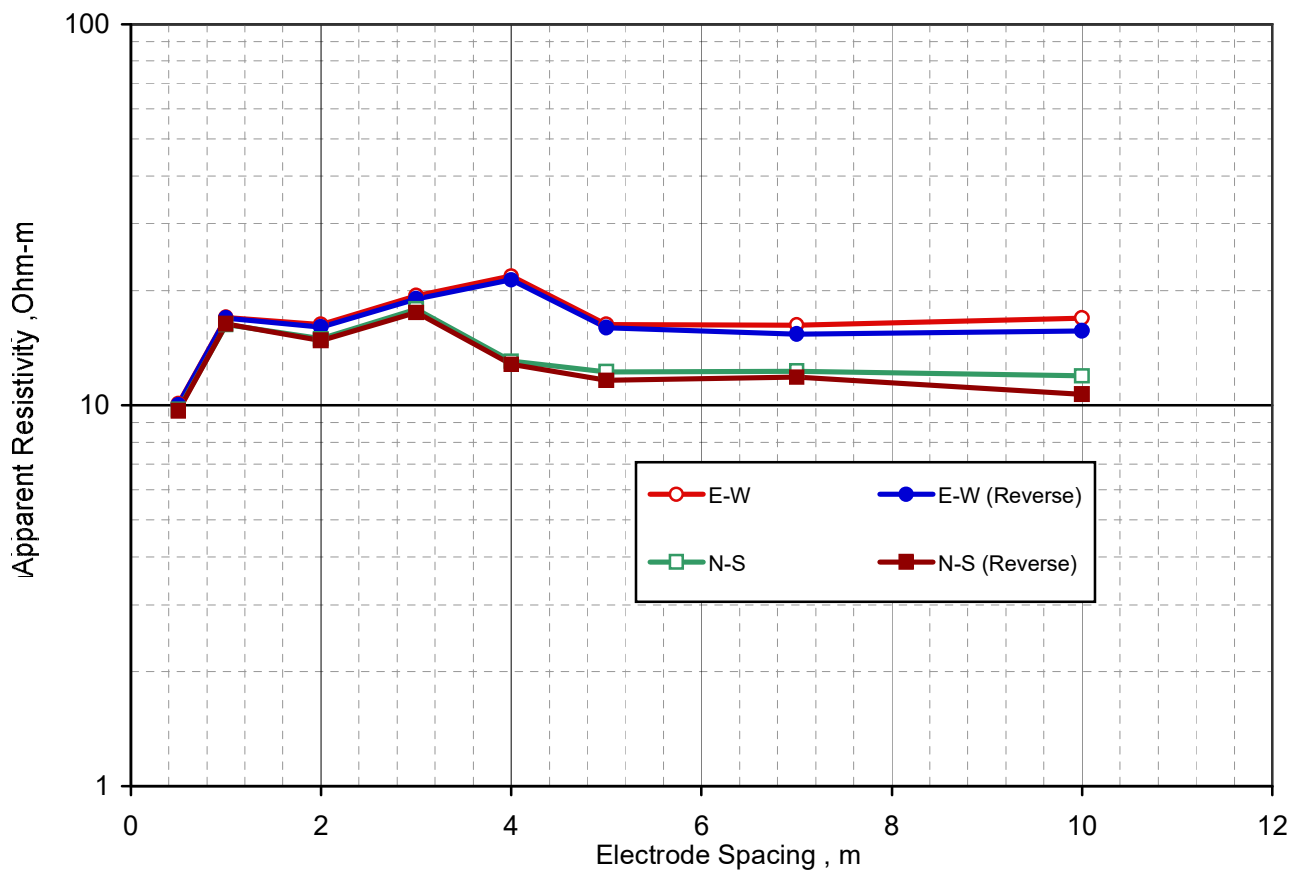
Time (h)	100 Year	50 Year	25 Year	10 Year	2 Year
25	85.88	64.01	59.10	44.06	20.13
26	80.73	71.59	55.46	41.25	18.67
27	66.59	66.80	45.48	33.61	14.84
28	52.87	54.07	35.96	26.45	11.49
29	41.56	42.09	28.26	20.77	9.04
30	33.16	32.75	22.62	16.69	7.38
31	26.74	26.32	18.30	13.55	6.07
32	21.56	21.29	14.80	10.99	4.99
33	17.13	17.25	11.79	8.78	4.03
34	13.71	13.69	9.47	7.08	3.32
35	11.12	10.98	7.72	5.80	2.78
36	8.89	8.91	6.21	4.70	2.32
37	6.97	7.16	4.91	3.74	1.90
38	5.49	5.63	3.90	3.00	1.59
39	4.46	4.45	3.21	2.50	1.39
40	3.49	3.63	2.55	2.01	1.18
41	2.61	2.87	1.95	1.57	0.98
42	1.97	2.17	1.50	1.24	0.84
43	1.47	1.64	1.17	1.00	0.73
44	1.05	1.25	0.88	0.78	0.63
45	0.71	0.92	0.65	0.61	0.56
46	0.59	0.65	0.56	0.55	0.53
47	0.55	0.55	0.54	0.54	0.53
48	0.53	0.53	0.53	0.53	0.53



**E r R T N ERT**

IS: 3043-1987, RA-2006

Test Details
Test Designation : ERT-1
Co-ordinate : 786314E, 3118913N



Electrode Spacing, m	Apparent Resistivity, Ohm-m			
	E-W	E-W (Reverse)	N-S	N-S (Reverse)
0.5	10.1	10.0	9.7	9.7
1.0	17.0	17.0	16.3	16.4
2.0	16.3	16.1	15.0	14.8
3.0	19.4	19.0	17.9	17.5
4.0	21.9	21.4	13.1	12.8
5.0	16.3	16.0	12.3	11.6
7.0	16.3	15.4	12.3	11.9
10.0	17.0	15.7	11.9	10.7
Mean Resistivity	17	16	14	13

Mean Resistivity Value, ohm-m : 11.9 ohm-m

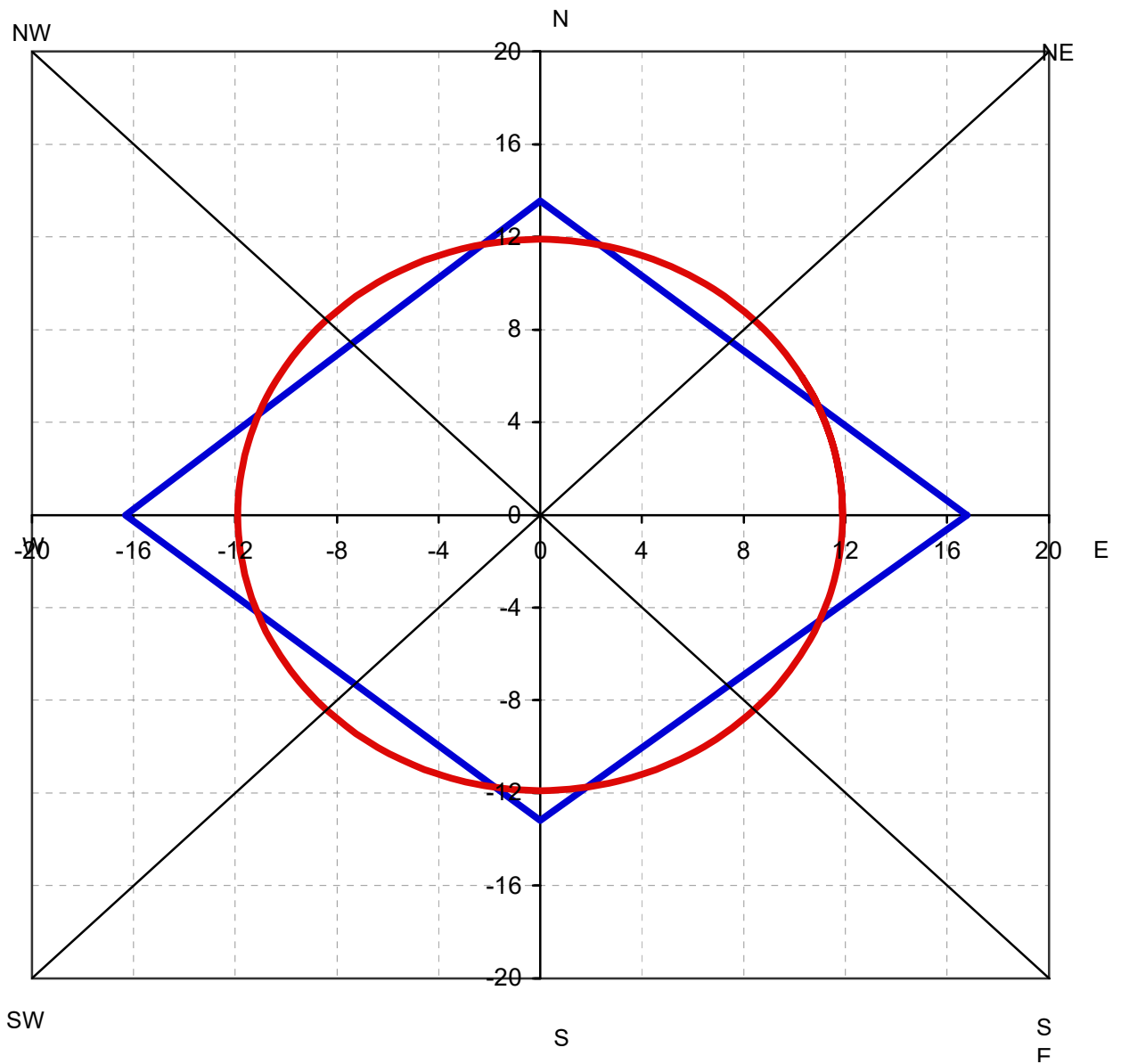
A r R**ERT**



ERT

IS: 3043-1987, RA-2006

Test Details
Test Designation : ERT-1
Co-ordinate : 786314E, 3118913N



Total Area of Polygon : 443

Radius of Equivalent Circle=Mean Resistivity : 12 ohm-m

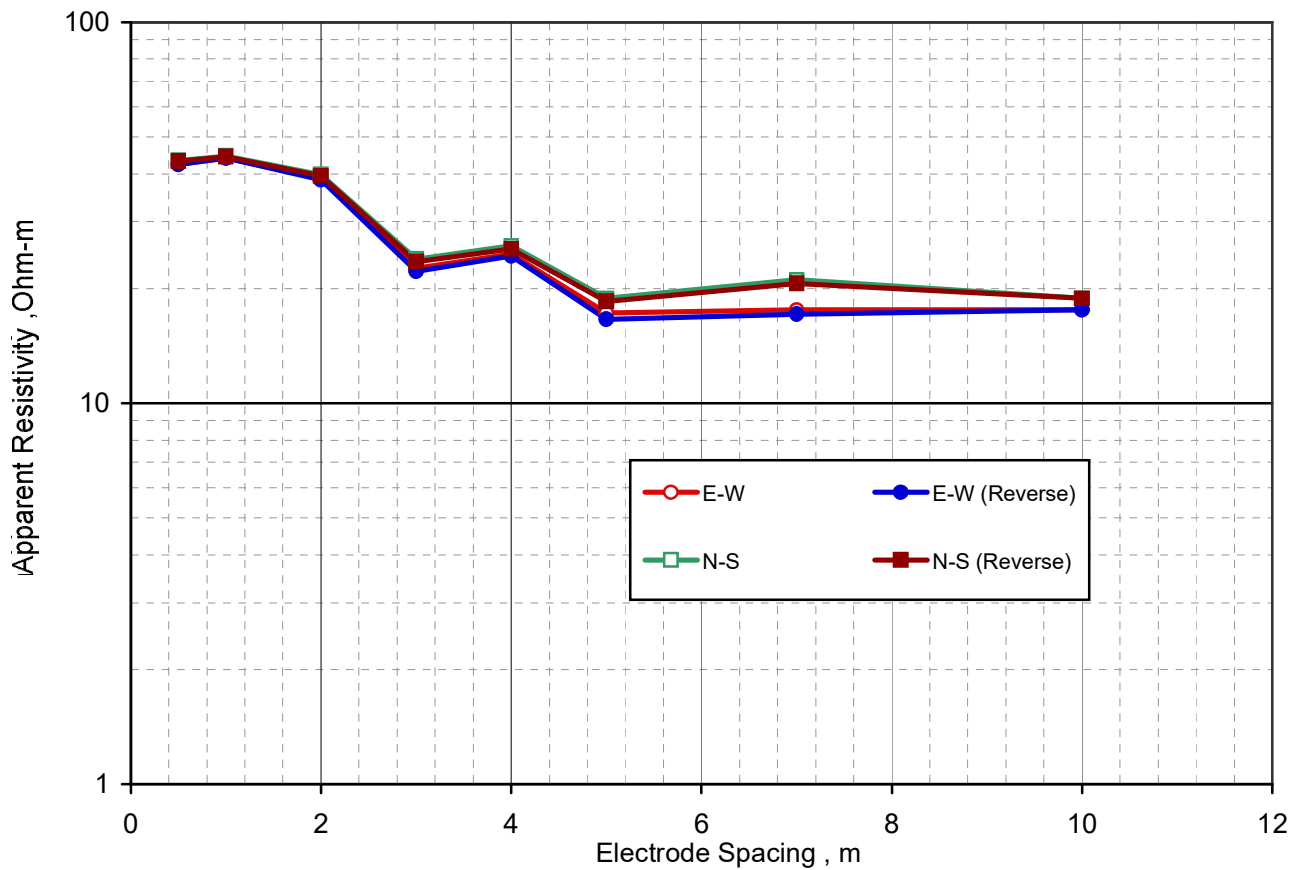
ERT



E r R T N ERT

IS: 3043-1987, RA-2006

Test Details
Test Designation : ERT-2
Co-ordinate : 786280E, 3119019N



Electrode Spacing, m	Apparent Resistivity, Ohm-m			
	E-W	E-W (Reverse)	N-S	N-S (Reverse)
0.5	42.4	42.3	43.4	43.2
1.0	44.0	44.0	44.6	44.4
2.0	39.0	38.6	39.8	39.5
3.0	22.6	22.2	23.9	23.6
4.0	24.6	24.4	25.9	25.4
5.0	17.3	16.7	18.8	18.5
7.0	17.6	17.2	21.1	20.7
10.0	17.6	17.6	18.8	18.8
Mean Resistivity	28	28	30	29

Mean Resistivity Value, ohm-m : 22.9 ohm-m

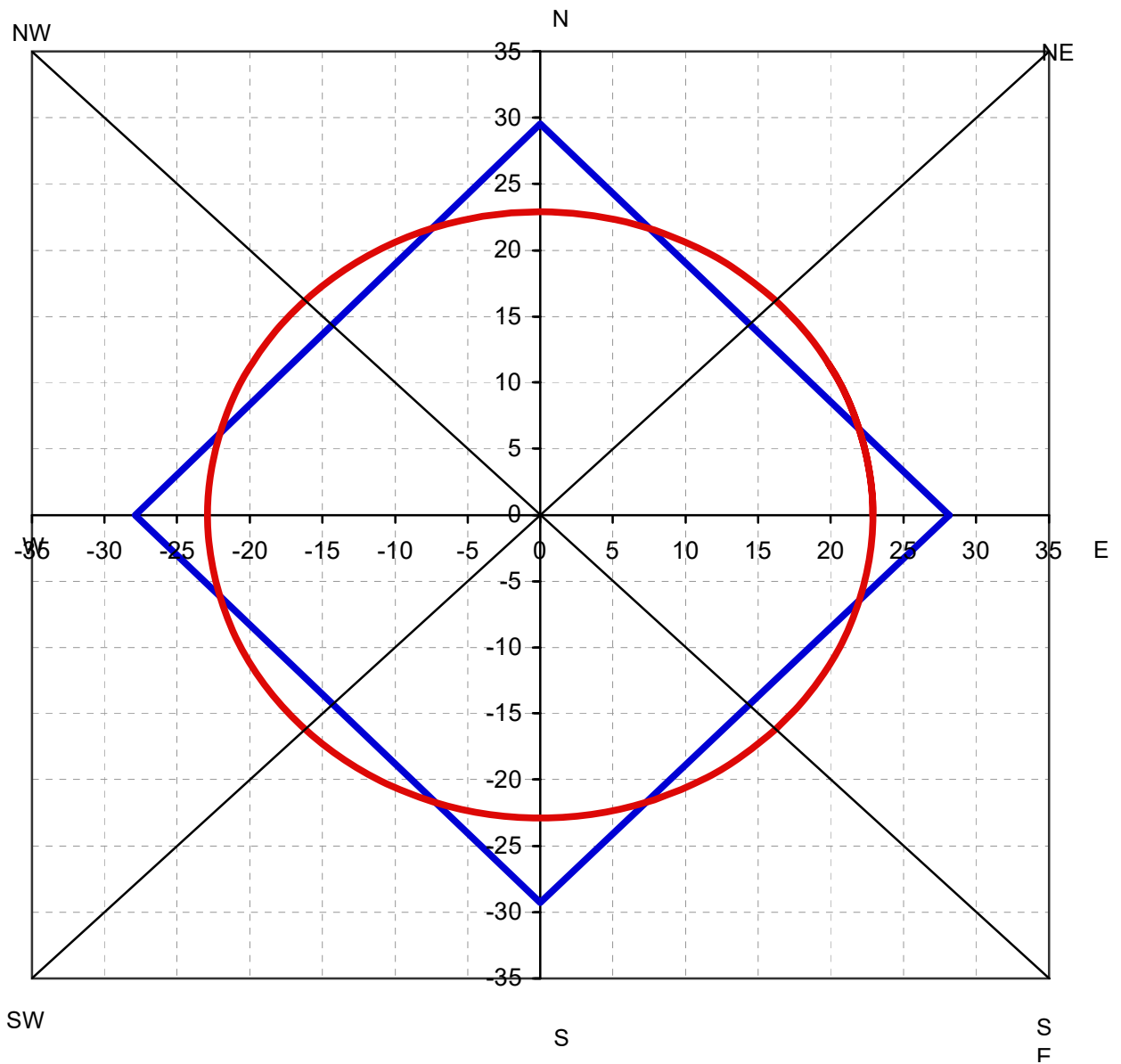
A r R ERT



E r R T N ERT

IS: 3043-1987, RA-2006

Test Details
Test Designation : ERT-2
Co-ordinate : 786280E, 3119019N



Total Area of Polygon : 1647

Radius of Equivalent Circle=Mean Resistivity : 23 ohm-m

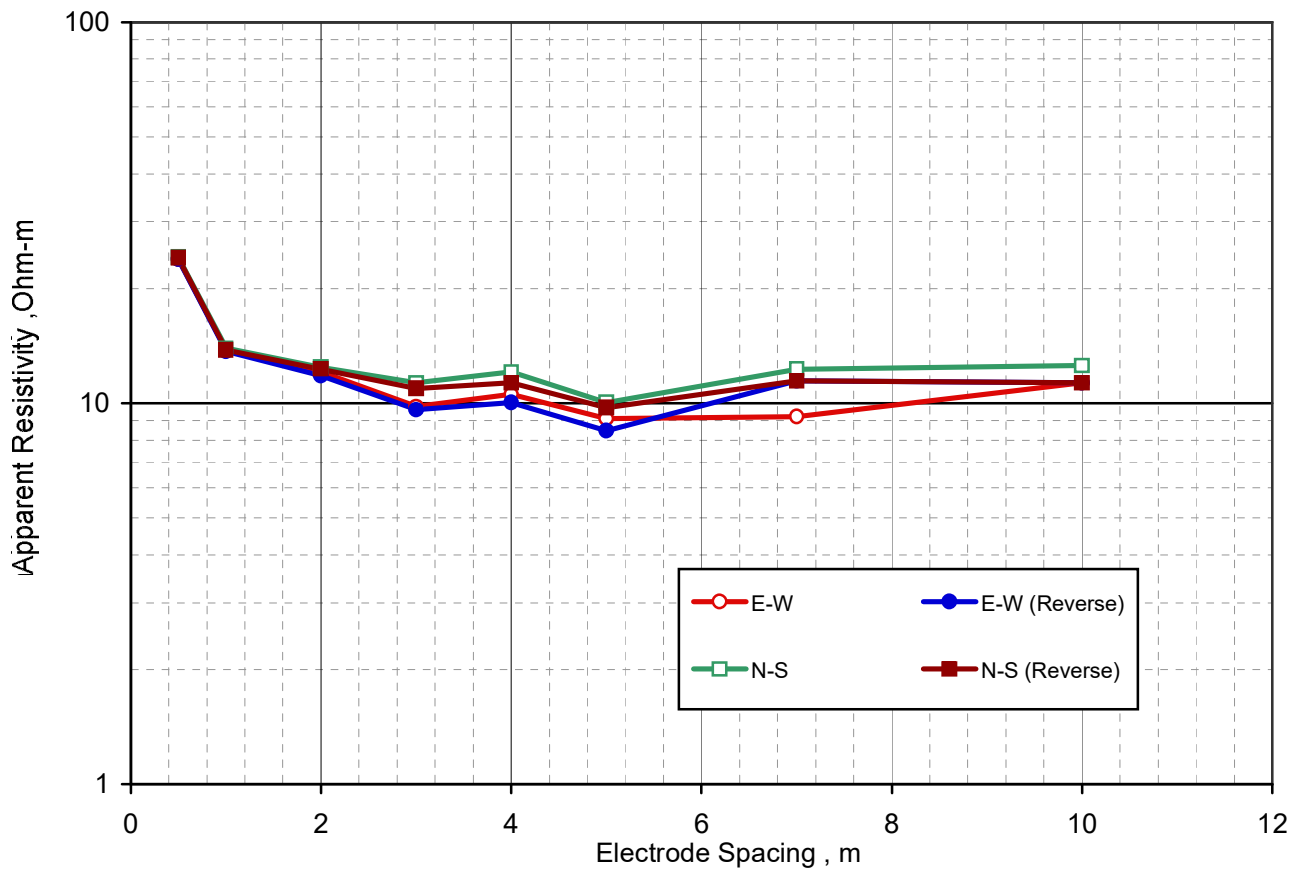
P r R C r ERT



E r R T N ERT

IS: 3043-1987, RA-2006

Test Details
Test Designation : ERT-3
Co-ordinate : 786234E, 3118900N



Electrode Spacing, m	Apparent Resistivity, Ohm-m			
	E-W	E-W (Reverse)	N-S	N-S (Reverse)
0.5	23.9	23.9	24.2	24.1
1.0	13.8	13.7	13.9	13.8
2.0	12.1	11.8	12.4	12.3
3.0	9.8	9.6	11.3	10.9
4.0	10.6	10.1	12.1	11.3
5.0	9.1	8.5	10.1	9.7
7.0	9.2	11.4	12.3	11.4
10.0	11.3	11.3	12.6	11.3
Mean Resistivity	12	13	14	13

Mean Resistivity Value, ohm-m : 10.3 ohm-m

A r R

ERT