

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
WASTE TO ENERGY PROJECT AT KAWAS, SURAT**

PART – C

GENERAL TECHNICAL REQUIREMENTS

SECTION – VI

BIDDING DOCUMENT NO.: BID DOC. NO.: CS-2600-001-9

NTPC Limited

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**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
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GENERAL TECHNICAL REQUIREMENTS

SECTION – VI

BID DOC. NO.: CS-2600-001-9

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KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE

PART - C

GENERAL TECHNICAL REQUIREMENTS

GENERAL TECHNICAL REQUIREMENTS



PART - C

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1.00.00	INTRODUCTION This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.			
2.00.00	BRAND NAME Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.			
3.00.00	BASE OFFER & ALTERNATE PROPOSALS The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognised that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.			
4.00.00	COMPLETENESS OF FACILITIES			
4.01.00	Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.			
4.02.00	All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All same standard components/ parts of same equipment provided, shall be interchangeable with one another.			
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4.03.00	For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.			
5.00.00	RULES, REGULATIONS, CODES & STANDARDS			
5.01.00	In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India, NTPC rules/codes of practices as well as of the locality where they will be installed, including the following: a) Indian Electricity Act b) Indian Electricity Rules c) Indian Explosives Act d) Indian Factories Act and State Factories Act e) Indian Boiler Regulations (IBR) f) Regulations of the Central Pollution Control Board, India g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India h) Pollution Control Regulations of Department of Environment, Government of India i) State Pollution Control Board. (j.) Rules for Electrical installation by Tariff Advisory Committee (TAC). (k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996 (l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998 (m.) Explosive Rules, 1983 (n.) Petroleum Act, 1984 (o.) Petroleum Rules, 1976,			
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5.02.00	(p.) Gas Cylinder Rules, 1981 (q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981 (r.) Workmen's Compensation Act, 1923 (s.) Workmen's Compensation Rules, 1924 (t.) NTPC Safety Rules for Construction and Erection (u.) NTPC Safety Policy (v.) Solid Waste Manage Rule 2016. (vi) Any other statutory codes / standards / regulations, as may be applicable. Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply: a) Bureau of Indian standards (BIS) b) Japanese Industrial Standards (JIS) c) American National Standards Institute (ANSI) d) American Society of Testing and Materials (ASTM) e) American Society of Mechanical Engineers (ASME) f) American Petroleum Institute (API) g) Standards of the Hydraulic Institute, U.S.A. h) International Organisation for Standardisation (ISO) i) Tubular Exchanger Manufacturer's Association (TEMA) j) American Welding Society (AWS) k) National Electrical Manufacturers Association (NEMA) l) National Fire Protection Association (NFPA) m) International Electro-Technical Commission (IEC)/European Norm (EN) n) Expansion Joint Manufacturers Association (EJMA)			
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5.03.00 5.04.00 5.05.00 5.06.00 5.07.00 5.08.00 6.00.00 6.01.00 6.02.00	o) Heat Exchange Institute (HEI) p) IEEE standard q) JEC standard Other International/ National standards such as DIN, JIS, VDI, EN, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English. Not used. In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern. Two (2) English language copies of all national and international codes and/or standards used in the design of the plant, equipment, civil, structural and architectural works shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award. In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect. A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification. EQUIPMENT FUNCTIONAL GUARANTEE The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract. Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.			
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7.00.00	DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS			
7.01.00	DESIGN OF FACILITIES All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere. The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.			
7.02.00	MAINTENANCE AND AVILABILITY CONSIDERATIONS Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list. Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours , clearly defining the spare parts and man-hour requirement for each stage. Lifting devices i.e. hoists and chain pulley jacks ,etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities. Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.			
8.00.00	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR			
8.01.00	Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical			
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	specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope. Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated. The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification. A comprehensive engg and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications. 8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in Annexure-VI to this Part-C, Section-VI of the Technical Specification. 8.03.00 The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following: 8.03.01 A) BASIC ENGINEERING DOCUMENTATION Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum: i) System description of all the mechanical, electrical, control & instrumentation & civil systems. ii) Technology scan for each system / sub-system & equipment. iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options. iv) Optimisation studies including thermal cycle optimisation. v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins.			
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	vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups. vii) Operation Philosophy and the control philosophy of the equipments/system covered under the scope. ix) General Layout plan of the Waste to Energy Project incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope. x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the bidder. xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer. B) DETAILED ENGINEERING DOCUMENTS i) General layout plan of the Waste To Energy Project. ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant. iii) Flow diagram, process and instrumentation diagrams along with write up and system description. iv) Performance curves for equipments v) Piping isometric, composite layout and fabrication drawings. vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules. vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors. viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like			
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	fans, pumps and flue gas treatment facilities like Bag filter, SNCR system, grab crane, fuel feeding system (pusher/ram), flue gas quenching, chemical feeding system (lime, activated carbon, Ammonia / Urea), ash handling system etc- as per criteria specified elsewhere in specification. ix) WTE Grate fired Boiler, turbine, Flue gas treatment facilities etc sizing calculations and performance data. Thermal load diagrams for grate. x) Mass and Energy Balance Diagram xi) Characteristic Curves/ Performance Correction Curves. xii) Comprehensive list of all terminal points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc. xiii) Power supply single line diagram, block logics, control schematics, electrical schematics, etc. xiv) Protection system diagrams and relay settings. xv) Cables schedules and interconnection diagrams. xvii) Cable routing plan. - xviii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, and installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc. xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points. xx) Sequence and protection interlock schemes. xxi) Type test reports, insulation co-ordination study report xxii) Control system configuration diagrams and card circuit diagrams and maintenance details. - xxiii) Detailed Control system manuals.		
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8.03.02	xxiv) Detailed flow chart for digital control system. xv) Mimic diagram layout, Assignment for other application engg. drawings and documents. xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the scope of the bidder civil calculation sheets including structural analysis and design alongwith output results. xxvii) Underground facilities, levelling, sanitary, land scaping drawings. xxviii) Geotechnical investigation and site survey reports (if and as applicable). xxix) Model study reports wherever applicable. xxx) Functional & guarantee test procedures and test reports. xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification. xxxii) Maintenance schedule for WTE Grate fired Boiler & auxiliaries, Turbine, flue gas treatment facilities clearly indicating interval, duration if shutdown required, manhours required and tools & tackles required for maintenance. The Contractor's while submitting the above documents/ drawings for approval/ reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.		
	INSTRUCTION MANUALS The Contractor shall make first submission of instruction manual for all the equipments covered under the Contract as per agreed engineering information schedule. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in Annexure-IV. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following. A) ERECTION MANUALS		
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	The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum. - Erection strategy. - Sequence of erection. - Erection instructions. - Critical checks and permissible deviation/tolerances. - List of tool, tackles, heavy equipments like cranes, dozers, etc. - Bill of Materials - Procedure for erection and General Safety procedures to followed during erection/installation. - Procedure for initial checking after erection. - Procedure for testing and acceptance norms. - Procedure / Check list for pre-commissioning activities. - Procedure / Check list for commissioning of the system. - Safety precautions to be followed in electrical supply distribution during erection. B) OPERATION & MAINTENANCE MANUALS - The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side. - The arrangement and contents of O & M manuals shall be as follows:		
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	1) <u>Chapter 1 - Plant Description</u>: To contain the following sections specific to the equipment/system supplied (a) Description of operating principle of equipment / system with schematic drawing / layouts. (b) Functional description of associated accessories / controls. Control interlock protection write up. (c) Integrated operation of the equipment alongwith the intended system. (This is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers). (d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries. (e) Design data against which the plant performance will be compared. (f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets. (g) Identification system adopted for the various components, (it will be of a simple process linked tagging system). (h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume). 2) <u>Chapter 2.0 - Plant Operation</u>: To contain the following sections specific to the equipment supplied (a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc. (b) Limiting values of all protection settings. (c) Various settings of annunciation/interlocks provided. (d) Startup and shut down procedure for equipment alongwith the associated systems in step mode. (e) Do's and Don'ts related to operation of the equipment.		
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	(f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions. (g) Parameters to be monitored with normal value and limiting values. (h) Equipment isolating procedures. (i) Trouble shooting with causes and remedial measures. (j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing. (k) Routine Operational Checks, Recommended Logs and Records (l) Change over schedule if more than one auxiliary for the same purpose is given. (m) Preservation procedure on long shut down. (n) System/plant commissioning procedure. 3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied. (a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population. (b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment. (c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc. (d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc. (e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out. (f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done. (g) Long term maintenance schedules			
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	(h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling. (i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement. (j) Tolerance for fitment of various components. (k) Details of sub vendors with their part no. in case of bought out items. (l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC. (m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares. (n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares. (o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.			
8.03.03	After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer. If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.			
8.03.03	PLANT HANDBOOK AND PROJECT COMPLETION REPORT			
8.03.03.01	PLANT HANDBOOK			
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	The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including i) Design and performance data. ii) Process & Instrumentation diagrams. iii) Single line diagrams. iv) Sequence & Protection Interlock Schemes. v) Alarm and trip values. vi) Performance Curves. vii) General layout plan and layout of main plant building and auxiliary buildings viii) Important Do's & Don't's The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.			
8.03.03.02	PROJECT COMPLETION REPORT			
	The Contractor shall submit a Project Completion Report at the time of handing over the plant.			
8.03.04	DRAWINGS			
	a) i) All the WTE plant layouts shall be made in computerised 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check. ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-VI of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC.			
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	Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site. The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats. iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per Annexure-VI of Part-C. iv) Contractor shall prepare the model of all the facilities located in Waste to Energy (WtE) (including all facilities), and any other facility 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. Contractor shall make a presentation on 3D model every 3 months from LOA to enable NTPC to review the progress of engineering. After the completion of engineering the corresponding complete 3D review model shall be handed over to the employer for its reference. Contractor shall provide 3D model (which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc), which is extracted from intelligent 3D model, for employer's review as & when desired by employer. However, all piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), 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. b) All documents/text information shall be in latest version of MS Office / MS Excel / PDF FORMAT as applicable. c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules. d) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and			
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	revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units. e) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract. The Contractor shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Employer. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY". Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission. Further, space shall be identified on each drawing for Approval stamp and electronic signature. f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract. g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer. h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating			
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	the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package. Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability. j) As Built Drawings After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to “as built” conditions and submit no. of copies as per Annexure VI. k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. l) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure			
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8.04.00	of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule. m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing. n) The Contractor shall submit drawings in line with the suggestive MDL covered in Part-B, Section-VI of Technical Specification and which shall be duly integrated with approved PERT network.			
	ENGINEERING INFORMATION SUBMISSION SCHEDULE Prior to the award of Contract, a Detailed Engineering Information Submission Scheduler/Master Drawing List duly integrated with approved PERT network shall be tied up with the Employer. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorized into the following parts. i) Information that shall be submitted for the approval to the Employer before proceeding further, and ii) Information that would be submitted for Employer's information only. The Master Drawing List (MDL) shall be updated periodically and submitted to the employer, highlighting the changes made in MDL. The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.			
	ENGINEERING PROGRESS AND EXCEPTION REPORT The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission b) Drawings which were not submitted as per agreed schedule.			
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8.05.02	The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.			
8.06.00	Engineering Co-ordination Procedure			
8.06.01	The following principal coordinators will be identified by respective organizations at time of award of contract: NTPC Engineering Coordinator (NTPC EC): Name : _____ Designation : _____ Address : _____ a) Postal : _____ b) Telegraphic / e-Mail : _____ c) FAX : _____ TELEPHONE : _____ Contractor's/ Vendor's Engineering Coordinator (VENDOR EC): Name : _____ Designation : _____ Address : _____ a) Postal : _____ b) Telegraphic / e-Mail : _____ c) FAX : _____ TELEPHONE : _____			
8.06.02	All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.			
8.06.03	Contractor's/Vendor's Drawing Submission and Approval Procedure: a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings".			
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	b) The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering. c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance. d) Employer and contractor shall follow their own numbering systems for the drawings. However, Employer shall intimate the contractor, NTPC drawing number on receipt of the first submission of each drawing. Vendor, thereafter, shall indicate NTPC's drawing number in subsequent Submission, in the space provided for this purpose in title plate, in addition to his own drawing number. e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. f) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. g) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within four (4) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories : CATEGORY- I: Approved CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.			
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	CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted. CATEGORY -IV For information and records. h) Contractor shall resubmit the drawings approved under Category II, III & IVR within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents. i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work. j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule. k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing. l) These comments will be taken care by the contractor while submitting the revised drawing. The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc. 9.00.00 TECHNICAL CO-ORDINATION MEETING 9.01.00 The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's			
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	representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.			
9.02.00	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.			
9.02.01	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.			
9.02.02	Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.			
9.03.0	Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.			
10.00.00	DESIGN IMPROVEMENTS The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.			
11.00.00	EQUIPMENT BASES A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive			
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	assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.			
12.00.00	PROTECTIVE GUARDS Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.			
13.00.00	LUBRICANTS, SERVO FLUIDS AND CHEMICALS			
13.01.00	I. All the first fills of consumables and one years topping requirement of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder 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. The additional quantity shall be supplied in separate container.			
13.02.00	As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible. Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.			
14.00.00	LUBRICATION			
14.01.00	Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.			
15.00.00	MATERIAL OF CONSTRUCTION			
15.01.00	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.			
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16.00.00 16.01.00 16.02.00 16.03.00 16.04.00 16.05.00 16.06.00 16.07.00	RATING PLATES, NAME PLATES & LABELS Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer. Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications. Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear side. Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum. Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support or hanger. Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body. Safety and relief valves shall be provided with the following: - Manufacturer's identification. - Nominal inlet and outlet sizes in mm. - Set pressure in Kg/cm² (abs). - Blowdown and accumulation as percentage of set pressure. - Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.			
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16.08.00	All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.			
16.09.00	All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.			
17.00.00	TOOLS AND TACKLES The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer. The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. In case these tools and tackles are used by the Contractor during erection, commissioning or initial operation the same shall be refurbished repaired/replaced as required to the satisfaction of the Employer before handing over to the Employer. All the tools and tackles shall be of reputed make acceptable to the Employer.			
18.00.00	WELDING			
18.01.00	If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be per formed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.			
19.00.00	COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES			
19.01.00	All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.			
20.00.00	PROTECTION AND PRESERVATIVE SHOP COATING			
20.01.00	PROTECTION All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with			
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	either metallic or a nonmetallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be. The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.			
20.02.00	PRESERVATIVE SHOP COATING All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification. Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.			
20.03.00	Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.			
20.04.00	All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.			
20.05.00	All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.			
20.06.00	Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.			
21.00.00	QUALITY ASSURANCE PROGRAMME			
21.01.00	To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's			
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	premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS-14001. A quality assurance programme of the contractor shall generally cover the following: - His organisation structure for the management and implementation of the proposed quality assurance programme - Quality System Manual - Design Control System - Documentation Control System - Qualification data for Bidder's key Personnel. - The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc. - System for shop manufacturing and site erection control including process controls and fabrication and assembly controls. - Control of non-conforming items and system for corrective actions. - Inspection and test procedure both for manufacture and field activities. - Control of calibration and testing of measuring testing equipments. - System for Quality Audits. - System for indication and appraisal of inspection status. - System for authorising release of manufactured product to the Employer. - System for handling storage and delivery. - System for maintenance of records, and - Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per formats enclosed as Annexure-I and Annexure-II respectively.			
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22.00.00	GENERAL REQUIREMENTS - QUALITY ASSURANCE			
22.01.00	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-1/F3-R0. Monthly progress reports shall be furnished.			
22.02.00	Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through C-folders, a web based system of NTPC ERP in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM (As per format at Annexure-I)			
22.03.00	Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site (As per format at Annexure – II).			
22.04.00	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. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.			
22.05.00	The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at Annexure-V . The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding			
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22.06.00 22.07.00 22.08.00 22.09.00 22.10.00 22.11.00 22.12.00	procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site. The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities. 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). All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details. All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing. All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer. Welding procedure qualification & Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorized representative. For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping system ASME B31.1 or other relevant code as applicable shall be followed. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding			
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22.13.00	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.			
22.14.00	No welding shall be carried out on cast iron components for repair.			
22.15.00	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.			
22.16.00	All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination) or equivalent. NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.			
	In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40 mm shall be ultrasonically tested.			
22.17.00	The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Monthly progress reports on sub-contractor detail submission / approval shall be furnished preferably on enclosed format at Annexure-IV . Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.			
22.18.00	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.			
	Such quality plans of the successful vendors shall be finalised with the Employer			
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	and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.			
22.19.00	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.			
22.20.00	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.			
22.21.00	Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.			
22.22.00	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.			
22.23.00	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.			
22.24.00	Environmental Stress Screening Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be necessarily furnished for any sub vendors proposed for vendor assessment and approval for this contract. For other approved sub vendors of above mentioned systems, contractor shall furnish the test procedure for eliminating infant mortile components in case, if it is asked for by the employer before these items are offered for inspection / dispatched to site.			
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22.25.00	The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.			
22.26.00	<u>Software Reliability / Quality Certification</u> Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β-version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.			
23.00.00	QUALITY ASSURANCE DOCUMENTS			
23.01.00	The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (✓)mark.			
23.01.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing. The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.			
23.02.00	Typical contents of QA Documentation is as below:- (a.) Quality Plan			
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	(b.) Material mill test reports on components as specified by the specification and approved Quality Plans. (c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans. (d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment. (e.) Heat Treatment Certificate/Record (Time- temperature Chart) (f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure). (g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points. (h.) Certificate of Conformance (COC) wherever applicable. (i.) MDCC 23.03.00 Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system. 23.04.00 Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review. (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release. (b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector. (c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the			
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23.05.00	supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment. TRANSMISSION OF QA DOCUMENTATION On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer. For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.			
24.00.00	PROJECT MANAGER'S SUPERVISION			
24.01.00	To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.			
24.02.00	The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following: (a.) Interpretation of all the terms and conditions of these documents and specifications (b.) Review and interpretation of all the Contractor's drawing, engineering data, etc (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract (d.) Inspect, accept or reject any equipment, material and work under the contract (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates			
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	(f.) Review and suggest modifications and improvement in completion schedules from time to time, and (g.) Supervise Quality Assurance Programme implementation at all stages of the works.			
25.00.00	INSPECTION, TESTING AND INSPECTION CERTIFICATES			
25.01.00	The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.			
25.02.00	The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.			
25.03.00	The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.			
25.04.00	The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.			
25.05.00	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from			
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	proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract. 25.06.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing. 25.07.00 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract. 25.08.00 To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 25.03.00 of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month. 25.09.00 All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector. 25.10.00 Associated document for Quality Assurance programme 25.10.01 Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at Annexure-I. 25.10.02 Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at Annexure-II. 25.10.03 List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 (Annexure-III). 25.10.04 Status of items requiring Quality Plan and sub supplier approval. Format enclosed at Annexure-IV. 25.10.05 Field Welding Schedule Format enclosed at Annexure-V.			
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25.11.00	Not Used			
25.12.00	DEMONSTRATION OF APPLICATION ENGINEERING			
25.12.01	Based on NTPC inputs, the Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following. (i) Logics/Loops: a) Drive logics implementation for each type of binary drive along with its display in HMI. b) Sequence implementation along with its display in HMI. c) Single non-cascade controller implementation. d) Cascade loop implementation. e) Master slave implementation with different slave combination. f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable. (ii) HMI Functions: a) LVS Annunciation. b) Graphics. c) HSR d) Logs/Reports. e) Calculations (Basic & Performance Calculations).			
25.12.02	The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings. After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor based on NTPC inputs. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations in a format to be provided by the Employer and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.			
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25.12.03	During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.			
26.00.00	PRE-COMMISSIONING AND COMMISSIONING FACILITIES			
26.01.00	(a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications. (b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant. (c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness. (d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period. (e) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs(standard check list)/TS(testing schedule)/CS(commissioning schedule)] approved by the employer. (f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is			
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26.01.00 26.02.00	running at the base load, peak load as well as lowest sustained operating condition as far as practicable. Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain: (1.) Biodata including experience of the Commissioning Engineers. (2.) Role and responsibilities of the Commissioning Organisation members. (3.) Expected duration of posting of the above Commissioning Engineers at site. Initial Operation (a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests. (b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the WTE Plant shall operate continuously at full load for a period not less than 72 hours. The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility. The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect. (c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation. (d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor			
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26.03.00	repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission. Guarantee Tests a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up and initial operation shall make the unit ready to conduct such test. Such test will be commenced, within a period of <u>three (3) months</u> after the successful completion of Initial Operations. Any extension of time beyond the above <u>three (3) months</u> shall be mutually agreed upon. b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee. c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points. d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost. e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.			
27.00.00	TAKING OVER Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be with held nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.			
28.00.00	TRAINING OF EMPLOYER'S PERSONNEL			
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28.01.00	Training for Employers O&M Personnel The scope of service under training of Employer's engineers shall include a training module covering upto six (6) man months in the areas of Operation & Maintenance at NTPC Kawas site. Such training should enable the personnel to individually take the responsibility of operating and maintaining the WtE Plant in a manner acceptable to the Employer.			
28.02.00	Training for Employers Engineering Personnel The scope of services under training for Employer's engineering personnel shall also necessarily include two (2) man month. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. An indicative module of the training requirement of Employer's Engineering personnel is attached as Annexure-VII.			
28.03.00	Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Employer's approval. Consolidated training period included above (i.e. 6 and 2 man months respectively for O&M and Engineering) is indicative only. Employer reserves the right to re appropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.			
28.04.00	Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.			
28.05.00	In all the above cases, wherever the training of Employer's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Employer's personnel shall be at the cost of Contractor. The Contractor shall make all necessary arrangements towards the same.			
28.06.00	Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award.			
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	Note: For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.			
29.00.00	SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION			
	In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:			
	i) Working platforms should be fenced and shall have means of access.			
	ii) Ladders in accordance with Employer’s safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.			
30.00.00	NOISE LEVEL			
	The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA .			
31.00.00	PACKAGING AND TRANSPORTATION			
	All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.			
32.00.00	ELECTRICAL EQUIPMENTS/ENCLOSURES			
32.01.00	All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.			
33.00.00	INSTRUMENTATION AND CONTROL			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 42 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
33.01.00	All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.			
	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.			
	All scales and charts shall be calibrated and printed in Metric Units as follows:			
	1. Temperature	-	Degree centigrade (deg C)	
	2. Pressure	-	Kilograms per square centimetre (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.	
	3. Draught	-	Millimetres of water column (mm wc).	
	4. Vacuum	-	Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).	
	5. Flow (Gas)	-	Tonnes/ hour	
	6. Flow (Steam)	-	Tonnes/ hour	
	7. Flow (Liquid)	-	Tonnes / hour	
33.02.00	8. Flow base	-	760 mm Hg. 0 deg.C	
	9. Density	-	Grams per cubic centimeter.	
33.03.00	All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.			
33.03.00	All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.			
34.00.00	ELECTRICAL NOISE CONTROL			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).			
35.00.00	SURGE PROTECTION FOR SOLID STATE EQUIPMENT All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.			
36.00.00	INSTRUMENT AIR SYSTEM The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.			
37.00.00	TAPPING POINTS FOR MEASUREMENTS Tapping points shall include probes, wherever applicable, for analytical measurements and sampling. For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor. i) Temperature test pockets with stub and thermowell ii) Pressure test pockets			
38.00.00	SYSTEM DOCUMENTATION			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for control system shall include as a minimum to that specified elsewhere in the Technical Specification. The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.			
38.01.00	Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.			
39.00.00	MAINTENANCE MANUALS OF ELECTRONIC MODULES The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further , the contractor shall furnish a set of operating manuals which should include block diagrams ,make, model/type ,details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	LIST OF CODES AND STANDARDS			
	Indian Standards	Title	International and Internationally recognised standards	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:1239 Part-I IS:1239 Part-II IS:2825 IS:1520 IS:1600 IS:1601 IS:1893 IS1978-1971 IS:2254-1970 IS:2266 IS:2312 IS:2365	Mild steel tubes Mild steel tubulars and other wrought steel pipe fittings Code for unfired vessels Horizontal centrifugal pumps for clear cold and fresh water Code for practice for performance of constant speed IC Engines for general purpose Specification for performance of constant speed IC Engines for general Purpose Criteria for earthquake resistant design of structures Line Pipe April 1969. Dimensions of vertical shaft motor for pumps Steel wire ropes for general engineering purposes Propellant type Ventilation fans Steel wire suspension ropes for lifts and hoists	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957) BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965 API Standards 5L IEC Pub 72-1 part I NEMA Pub MG 1 1954 BS :302 : 1968 BS : 1957	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963	
	IS:3354	Outline dimensions for electric lifts.		
	IS:3401	Silica gel		
	IS:3588	Specification for electrical axial flow fans		
	IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)		
	IS:3677	Unbonded rock and slag wool for thermal insulation		
	IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)	
	IS:3895	Specification for monocry-stallines semiconductor rectifier cells and stacks		
	IS:3963	Roof extractor unit		
	IS:3975	Mild steel wires, strips and tapes for armouring cables		
	IS:4503	Shell and tube type heat Exchanger		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:4540 IS:4671 IS:4736 IS:4894 IS:5456 IS:5749 IS:6392 IS:6524 Part-I IS:7098 IS:7373 IS:7938 ISO:1217 ASHRAE-33 and air heating coils. ASHRAE-52-76	Specification for monory-stallines rectifire assembly equipment Expanded polystyrene for thermal insulation purpose Hot dip zinc coating on steel tubes Centrifugal fans Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only) Forged ramshorn hooks Steel pipe flanges Code of practice for design of tower cranes Static and rail mounted Cross linked Polyethylene insulated PVC sheathed cables Specification for wrought aluminium and aluminium sheet and strips Air receivers for compressed air installation Displacement compressor-Acceptance test Methods of testing for rating of forced circulation air cooling Air cleaning device used in general ventilation for removing particle matter.	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958 BS 4504 : 1969 BS 2799 : 1956 Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers. ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors. ARI-450-6 Standard for water cooled refrigerant condensers. ARI-550 Standard for centrifugal water chilling packages. ARI-410 Standard for forced circulation air cooling and air heating coils ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 Fans (Part-1,2) BS:400 Low carbon steel cylinders for the storage & transport of permanent gases. BS:401 Low carbon steel cylinders for the storage & transport of liquified gases. CTI Code Acceptance test code for Water Cooling Tower. ACT-105 ANSI-31.5 Refrigerant piping ASME-PTC- Atmospheric Water Cooling Equipment 23-1958 AMCA A-21C Test Code for air moving devices API:618 Reciprocating Compressor for general refinery services. HYDRAULIC INSTITUTE STANDARDS. HYDRANT SYSTEM MANUALS OF TAC. TAC MANUALS OF SPRAY SYSTEM NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS. INDIAN EXPLOSIVES ACT. INDIAN FACTORIES ACT. STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	CODE AND STANDARD FOR CIVIL WORKS Some of the applicable Standards, Codes and references are as follows: Excavation & Filling IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc. IS: 4701 Code of practice for earth work on canals. IS: 9758 Guide lines for Dewatering during construction. IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. Properties, Storage and Handling of Common Building Materials IS: 269 Specification for ordinary Portland cement, 33 grade. IS: 383 Specification for coarse and fine aggregates from natural sources for concrete. IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement. IS: 455 Specification for Portland slag cement. IS: 702 Specification for Industrial bitumen. IS: 712 Specification for building limes. IS: 808 Rolled steel Beam channel and angle sections. IS: 1077 Specification for common burnt clay building bricks. IS: 1161 Specification of steel tubes for structural purposes. IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C. IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B. IS: 1367 Technical supply conditions for Threaded fasteners. IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	(Part-II)	Calcined clay based.		
	IS: 1542	Specification for sand for plaster.		
	IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.		
	IS: 1786	Specification for high strength deformed bars for concrete reinforcement.		
	IS: 2062	Specification for steel for general structural purposes.		
	IS: 2116	Specification for sand for masonry mortars.		
	IS: 2386 (Parts-I to VIII)	Testing of aggregates for concrete.		
	IS: 3150	Hexagonal wire netting for general purpose.		
	IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.		
	IS: 3812	Specification for fly ash, for use as pozzolana and admixture.		
	IS: 4031	Methods of physical tests for hydraulic cement.		
	IS: 4032	Methods of chemical analysis of hydraulic cement.		
	IS: 4082	Recommendations on stacking and storage of construction materials at site.		
	IS: 8112	Specification for 43 grade ordinary portland cement.		
	IS: 8500	Medium and high strength structural steel.		
	IS: 12269	53 grade ordinary portland cement.		
	IS: 12894	Specification for Fly ash lime bricks.		
	Cast-In-Situ Concrete and Allied Works			
	IS: 280	Specification for mild steel wire for general engineering purposes.		
	IS: 456	Code of practice for plain and reinforced concrete.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS: 457 IS: 516 IS: 650 IS: 1199 IS: 1791 IS: 1838 (Part-I) IS: 2204 IS: 2210 IS: 2438 IS: 2502 IS: 2505 IS: 2506 IS: 2514 IS: 2645 IS: 2722 IS: 2750 IS: 2751 IS: 3025 IS: 3366 IS: 3370	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures. Method of test for strength of concrete. Specification for standard sand for testing of cement. Methods of sampling and analysis of concrete. General requirements for batch type concrete mixers. Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type). Code of practice for construction of reinforced concrete shell roof. Criteria for the design of reinforced concrete shell structures and folded plates. Specification for roller pan mixer. Code of practice for bending and fixing of bars for concrete reinforcement. General requirements for concrete vibrators, immersion type. General requirements for concrete vibrators, screed board type. Specification for concrete vibrating tables. Specification for Integral cement water proofing compounds. Specification for portable swing weigh batches for concrete. (single and double bucket type) Specification for Steel scaffolding. Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction. Methods of sampling and test waste water. Specification for Pan vibrators. Code of practice for concrete structures for the storage of		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	(Part I to IV) IS: 3414 IS: 3550 IS: 3558 concrete. IS: 4014 (Parts I & II) IS: 4326 of buildings. IS: 4461 IS: 4656 IS: 4925 IS: 4990 IS: 4995 (Parts I & II) IS: 5256 IS: 5525 concrete work. IS: 5624 IS: 6461 IS: 6494 IS: 6509 IS: 7861 IS: 9012 IS: 9103	liquids. Code of practice for design and installation of joints in buildings. Methods of test for routine control for water used in industry. Code of practice for use of immersion vibrators for consolidating concrete. Code of practice for steel tubular scaffolding. Code of practice for earthquake resistant design and construction of buildings. Code of practice for joints in surface hydro-electric power stations. Specification for form vibrators for concrete. Specification for batching and mixing plant. Specification for plywood for concrete shuttering work. Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. Code or practice for sealing joints in concrete lining on canals. Recommendations for detailing of reinforcement in reinforced concrete work. Specification for foundation bolts. Glossary of terms relating to cement concrete. Code of practice for water proofing of underground water reservoirs and swimming pools. Code of practice for installation of joints in concrete pavements. Code of practice for extreme weather concreting. (Parts I & II) Recommended practice for shot concreting. Specification for admixtures for concrete.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		IS: 9417 Recommendations for welding cold worked steel bars for reinforced concrete construction. IS: 10262 Recommended guidelines for concrete mix design. IS: 11384 Code of practice for composite construction in structural steel and concrete. IS: 11504 Criteria for structural design of reinforced concrete natural draught cooling towers. IS: 12118 Specification for two-parts poly sulphide. IS: 12200 Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams. IS: 13311 Method of non-destructive testing of concrete. Part-1 Ultrasonic pulse velocity. Part-2 Rebound hammer. SP:23 Handbook of concrete mixes SP: 24 Explanatory Handbook on IS: 456-1978 SP: 34 Handbook on concrete reinforcement and detailing. Precast Concrete Works SP: 7(PartVII/ National Building Code- Structural design of prefabrication and Sec.7) systems building. IS: 10297 Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units. IS: 10505 Code of practice for construction of floors and roofs using pre-cast reinforced concrete units. Masonry and Allied Works IS: 1905 Code of Practice for Structural Safety of Buildings-Masonry walls. IS: 2212 Code of Practice for Brickwork.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	IS: 2250 Code of Practice for Preparation and use of Masonry Mortar. SP: 20 Explanatory hand book on masonry code. Sheeting Works IS:277 Galvanised steel sheets (plain or corrugated). IS: 459 Unreinforced corrugated and semi-corrugated asbestos cement sheets. IS: 513 Cold-rolled carbon steel sheets. IS: 730 Specification for fixing accessories for corrugated sheet roofing. IS: 1626 Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings. IS: 2527 Code of practice for fixing rain water gutters and down pipe for roof drainage. IS: 3007 Code of practice for laying of asbestos cement sheets. IS: 5913 Methods of test for asbestos cement products. IS: 7178 Technical supply conditions for tapping screw. IS: 8183 Bonded mineral wool. IS: 8869 Washers for corrugated sheet roofing. IS: 12093 Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. IS: 12866 Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced). IS: 14246 Specification for continuously pre-painted galvanised steel sheets and coils. Fabrication and Erection of Structural Steel Work IS: 2016 Specification for plain washers.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS: 814 IS: 1852 IS: 3502 IS: 6911 IS: 3757 IS: 6623 IS: 6649 IS: 800 IS: 816 IS: 4000 IS: 9595 IS: 817 IS: 1811 IS: 9178 IS: 9006 IS: 7215 IS: 12843 IS: 4353 SP: 6 (Part 1 to 7)	Specification for covered Electrodes for Metal Arc Welding for weld steel. Specification for Rolling and Cutting Tolerances for Hot rolled steel products. Specifications for chequered plate. Specification for stainless steel plate, sheet and strip. Specification for high strength structural bolts Specification for high strength structural nuts. High Tensile friction grip washers. Code of practice for use of structural steel in general building construction. Code of practice for use of Metal Arc Welding for General Construction. Code of practice for assembly of structural joints using high tensile friction grip fasteners. Code of procedure of Manual Metal Arc Welding of Mild Steel. Code of practice for Training and Testing of Metal Arc Welders. Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes). Criteria for Design of steel bins for storage of Bulk Materials. Recommended Practice for Welding of Clad Steel. Tolerances for fabrication steel structures. Tolerance for erection of structural steel. Recommendations for submerged arc welding of mild steel and low alloy steels. ISI Hand book for structural Engineers.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		IS: 1608 Method of Tensile Testing of Steel products other than sheets, strip, wire and tube. IS: 1599 Method of Bend Tests for Steel products other than sheet, strip, wire and tube IS : 228 Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel. IS : 2595 Code of Practice for Radio graphic testing. IS : 1182 Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates. IS : 3664 Code of practice for Ultra sonic Testing by pulse echo method. IS : 3613 Acceptance tests for wire flux combination for submerged Arc Welding. IS : 3658 Code of practice for Liquid penetrant Flaw Detection. IS : 5334 Code of practice for Magnetic Particle Flaw Detection of Welds. Plastering and Allied Works IS : 1635 Code of practice for field slaking of Building lime and preparation of putty. IS : 1661 Application of cement and cement lime plaster finishes. IS : 2333 Plaster-of-paris. IS : 2402 Code of practice for external rendered finishes. IS : 2547 Gypsum building plaster. IS : 3150 Hexagonal wire netting for general purpose. Acid and Alkali Resistant Lining IS : 158 Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting. IS : 412 Specification for expanded metal steel sheets for general purpose.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS : 4441 Code of practice for use of silicate type chemical resistant mortars. IS : 4443 Code of practice for use of resin type chemical resistant mortars. IS : 4456 Method of test for chemical resistant tiles. (Part I & II) IS : 4457 Specification for ceramic unglazed vitreous acid resistant tiles. IS : 4832 Specification for chemical resistant mortars. Part I Silicate type Part II Resin type Part III Sulphur type IS : 4860 Specification for acid resistant bricks. IS : 9510 Specification for bitumasitc, Acid resisting grade. Water Supply, Drainage and Sanitation IS : 458 Specification for concrete pipes. IS : 554 Dimensions for pipe threads, where pressure tight joints are made on thread. IS : 651 Specification for salt glazed stoneware pipes. IS : 774 Flushing cisterns for water closets and urinals. IS : 775 Cast iron brackets and supports for wash basins and sinks. IS : 778 Copper alloy gate, globe and check valves for water works purposes. IS : 781 Cast copper alloy screw down bib taps and stop valves for water services. IS : 782 Caulking lead. IS : 783 Code of practice for laying of concrete pipes.		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS PAGE 59 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS : 1172 IS : 1230 IS : 1239 IS : 1536 IS : 1537 IS : 1538 IS : 1703 IS : 1726 IS : 1729 IS : 1742 IS : 1795 IS : 1879 IS : 2064 IS : 2065 IS : 2326 IS : 2470 (Part-I & II) IS : 2501 IS : 2548 IS : 2556 (Part 1 to 15) IS : 2963	Basic requirements for water supply, drainage and sanitation. Cast iron rain water pipes and fittings. Mild steel tubes, tubulars and other wrought steel fittings. Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage. Vertically cast iron pressure pipes for water, gas and sewage. Cast iron fittings for pressure pipe for water, gas and sewage. Ball valves (horizontal plunger type) including float for water supply purposes. Cast iron manhole covers and frames. Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories. Code of practice for building drainage. Pillar taps for water supply purposes. Malleable cast iron pipe fittings. Code of practice for selection, installation and maintenance of sanitary appliances. Code of practice for water supply in building. Automatic flushing cisterns for urinals. Code of practice for installation of septic tanks. Copper tubes for general engineering purposes. Plastic seat and cover for water-closets. Vitreous sanitary appliances (vitreous china). Non-ferrous waste fittings for wash basins and sinks.		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 60 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	- IS : 3114 Code of practice for laying of cast iron pipes. - IS : 3311 Waste plug and its accessories for sinks and wash basins. - IS : 3438 Silvered glass mirrors for general purposes. - IS : 3486 Cast iron spigot and socket drain pipes. - IS : 3589 Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter). - IS : 3989 Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. - IS : 4111 (Part I to IV) Code of practice for ancillary structure in sewerage system. - IS : 4127 Code of practice for laying of glazed stone-ware pipes. - IS : 4764 Tolerance limits for sewage effluents discharged into inland-surface waters. - IS : 4827 Electro plated coating of nickel and chromium on copper and copper alloys. - IS : 5329 Code of practice for sanitary pipe work above ground for buildings. - IS : 5382 Rubber sealing rings for gas mains, water mains and sewers. - IS : 5822 Code of practice for laying of welded steel pipes for water supply. - IS : 5961 Cast iron grating for drainage purpose. - IS : 7740 Code of practice for road gullies. - IS : 8931 Cast copper alloy fancy bib taps and stop valves for water services. - IS : 8934 Cast copper alloy fancy pillar taps for water services. - IS : 9762 Polyethylene floats for ball valves. - IS : 10446 Glossary of terms for water supply and sanitation.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 61 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS : 10592	Industrial emergency showers, eye and face fountains and combination units.		
	IS : 12592	Specification for precast concrete manhole covers and frames.		
	IS : 12701	Rotational moulded polyethylene water storage tanks.		
	SP: 35	Hand book on water supply and drainage.		
	-	Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.		
	Doors, Windows and Allied Works			
	IS : 204	Tower Bolts		
	Part-I	Ferrous metals.		
	Part-II	Nonferrous metals.		
	IS : 208	Door Handles.		
	IS : 281	Mild steel sliding door bolts for use with padlocks.		
	IS : 362	Parliament Hinges.		
	IS : 420	Specification for putty, for use on metal frames.		
	IS : 1003 Part-I door	Specification for timber panelled and glazed shutters- (Part-I) shutters.		
	IS : 1038	Steel doors, windows and ventilators.		
	IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.		
	IS : 1341	Steel butt hinges.		
	IS : 1361	Steel windows for industrial buildings.		
	IS : 1823	Floor door stoppers.		
	IS : 1868	Anodic coatings on Aluminium and its alloys.		
	IS : 2202 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9		GENERAL TECHNICAL REQUIREMENTS
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		IS:2209 Mortice locks (vertical type). IS:2553 Safety glass IS:2835 Flat transparent sheet glass. IS:3548 Code of practice for glazing in buildings. IS:3564 Door closers (Hydraulically regulated). IS : 3614 Fire check doors; plate, metal covered and rolling type. IS:4351 Steel door frames. IS:5187 Flush bolts. IS:5437 Wired and figured glass IS:6248 Metal rolling shutters and rolling grills. IS:6315 Floor springs (hydraulically regulated) for heavy doors. IS:7196 Hold fasts. IS:7452 Hot rolled steel sections for doors, windows and ventilators. IS:10019 Mild steel stays and fasteners. IS:10451 Steel sliding shutters (top hung type). IS:10521 Collapsible gates. R oof Water Proofing and Allied Works IS:1203 Methods of testing tar and bitumen. IS:1322 Specification for bitumen felts for water proofing and damp proofing. IS:1346 Code of practice for water proofing of roofs with bitumen felts. IS:1580 Specification for bituminous compound for water proofing and caulking purposes.		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 63 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.		
	IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.		
	Floor Finishes and Allied Works			
	IS:1237	Specification for cement concrete flooring tiles.		
	IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.		
	IS:2114	Code of practice for laying in-situ terrazzo floor finish.		
	IS:2571	Code of practice for laying in-situ cement concrete flooring.		
	IS:3462	Specification for unbacked flexible PVC flooring.		
	IS:4971	Recommendations for selection of industrial floor finishes.		
	IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.		
	IS:8042	Specification for white portland cement.		
	IS:13801	Specification for chequered cement concrete flooring tiles.		
	Painting and Allied Works			
	IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.		
	IS:1477	Code of practice for painting of ferrous metals in buildings.		
	Part-I	Pretreatment.		
	Part-II	Painting.		
	IS:1650	Specification for colours for building and decorative finishes.		
	IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.		
	IS:2338	Code of practice for finishing of wood and wood based materials.		
	Part-I	Operations and workmanship		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 64 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	Part-II	Schedules		
	IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.		
	Part-I	Operations and workmanship.		
	Part-II	Schedule.		
	IS:2524	Code of practice for painting of nonferrous metals in buildings.		
	Part-I	Pretreatment.		
	Part-II	Painting.		
	IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.		
	IS:2933	Specification enamel paint, under coating and finishing.		
	IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.		
	IS:5410	Specification for cement paint		
	IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use		
	IS:6278	Code of practices for white washing and colour washing.		
	IS:10403	Glossary of terms relating to building finishes.		
	Piling and Foundation			
	IS:1080	Code of practice for design and construction of simple spread foundations.		
	IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.		
	IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).		
	IS:2950	Code of practice for designs and construction of Raft (Part-I) foundation.		
	IS:2974 (Part-I TO V)	Code of practice for design and construction of machine foundations.		
	IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 65 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:8009 Part-I Part-II IS:12070 DIN:4024 VDI:2056 VDI:2060 Stop Log and Trash Rack IS:4622 IS:5620 IS:11388 IS:11855 Roads IRC:5 IRC:14 IRC:16 IRC:19 IRC:21 IRC:34 IRC:36 IRC:37 IRC:56	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Shallow foundations. Deep foundations. Code of practice for design and construction of shallow foundations on rocks. Flexible supporting structures for machines with rotating machines. Criteria for assessing mechanical vibrations of machines. Criteria for assessing rotating imbalances in machines. Recommendations for fixed - wheel gates structural design. Recommendations for structural design criteria for low head slide gates. Recommendations for design of trash rack for intakes. General requirements for rubber seals for hydraulic gates. Standard specifications and Code of practice for road bridges, section-I general Features of Design. Recommended practice of 2cm thick bitumen and tar carpets. Specification for priming of base course with bituminous primers. Standard specifications and code of practice for water bound macadam. Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced). Recommendations for road construction in waterlogged areas. Recommended practice for the construction of earth embankments for road works. Guidelines for the Design of flexible pavements. Recommended practice for treatment of embankment slopes for erosion control.		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 66 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	IRC:73	Geometric design standards for rural (non-urban) highways.		
	IRC:86	Geometric Design standards for urban roads in plains.		
	IRC:SP:13	Guidelines for the design of small bridges & culverts.		
	IRC - Public- ation	Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.		
	IS:73	Specification for paving bitumen		
	Loadings			
	IS:875	Code of practice for design loads other than earthquake) for		
	(Pt. I to V)	buildings and structures.		
	IS:1893	Criteria for earthquake resistant design of structures.		
	IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.		
	IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.		
	M.O.T.	Deptt. of railways Bridge Rules.		
	Safety			
	IS:3696	Safety code for scaffolds and ladders.		
	(Part I & II)			
	IS:3764	Safety code for excavation work.		
	IS:4081	Safety code for blasting and related drilling operations.		
	IS:4130	Safety code for demolition of buildings.		
	IS:5121	Safety code for piling and other deep foundations.		
	IS:5916	Safety code for construction involving use of hot bituminous materials.		
	IS:7205	Safety code for erection on structural steelwork.		
	IS:7293	Safety code for working with construction machinery.		
	IS:7969	Safety code for handling and storage of building materials		
	IS:11769	Guidelines for safe use of products containing asbestos.		
	- Indian Explosives Act. 1940 as updated.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Architectural design of buildings SP:7 National Building Code of India SP:41 Hand book on functional requirements of buildings (other than industrial buildings) Miscellaneous IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers. IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. IS:10430 Creteria for design of lined canals and liner for selection of type of lining. IS:11592 Code of practice for selection and design of belt conveyors. IS:12867 PVC handrails covers. CIRIA Design and construction of buried thin-wall pipes. Publication REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents. Temperature Measurements 1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). 2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. 3. Temperature measuremnet by electrical Resistance thermometers - IS:2806. 4. Thermometer - element - Platinum resistance - IS:2848.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 68 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Pressure Measurements 1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). b) Electronic transmitters BS:6447. 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. 3. Process operated switch devices (Pr. Switch) BS-6134. Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software 1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. 2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. 3. Compatibility of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. 4. Dynamic response testing of process control instrumentation ISA - S 26 (1968). 5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. 6. Printed circuit boards - IPC TM - 650, IEC 326 C. 7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. 8. Edge socket connectors - IEC 130-11. 9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. 10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980).			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R). 12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. 13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. 14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. 15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988. 16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984. Instrument Switches and Contact 1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. 2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures 1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13).			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). 3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area 1. Classification of hazardous area - NFPA 70 - 1984, Article 500. 2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. 3. Intrinsically safe apparatus - NFPA 493 1978. 4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. 5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977. Sampling System 1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. Annunciators 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 3. Damp heat cycling test - IS:2106 4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Protections - Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. - General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. - Turbine water damage prevention - ASME TDP-1-1980. - Boiler safety interlocks - NFPA 85 - 2011 or latest version. UPS System - Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. - Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. - Surge withstand capability test - ANSI C 37.90 1 -1989. - Performance testing of UPS - IEC 146. - Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991. - Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. - Printed Circuit Board - IPC TM 650, IEC 326C. - General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. Control Valves - Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. - Face to face dimensions of control valves - ANSI B 16.00 - 1973. - ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2). - Codes for pressure piping - ANSI B 31.1 - Control Valve leak class - ISA RP 39.6		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 72 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Process Connection & Piping - Codes for pressure piping "power piping" - ANSI B 31.1. - Seamless carbon steel pipe ASTM - A - 106. - Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. - Material for socket welded fittings - ASTM - A - 105. - Seamless ferritic alloy steep pipe - ASTM - A - 335. - Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. - Composition bronze of ounce metal castings - ASTM - B - 62. - Seamless Copper tube, bright annealed - ASTM - B - 168. - Seamless copper tube - ASTM - B - 75. - Dimension of fittings - ANSI - B - 16.11. - Valves flanged and butt welding ends - ANSI - B - 16.34. Instrument Tubing - Seamless carbon steel pipe - ASTM - A 106. - Material of socketweld fittings - ASTM - A105. - Dimensions of fittings - ANSI - B - 16.11. - Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1. Cables - Thermocouples extension wires/cables - ANSI MC 96.1 - 1992. - Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83. 4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). 5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. 6. Rules for Testing insulated cables and flexible cables : VVDE - 0472 7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980) 8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81. 9. Oxygen index and temperature index test - ASTM D - 2863. 10. Smoke density measurement test - ASTMD - 2843. 11. Acid gas generation test - IEC - 754 - 1. 12. Swedish Chimney test - SEN - 4241475 (F3). 13. Teflon (FEP) insulation & sheath test - ASTMD - 2116. 14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784. 15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I). Cable Trays, Conduits 1. Guide for design and installation of cable systems in power generating staiton (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984. 2. -do- Test Standards. NEMA VE-1-1979. 3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTMA - 386-78. Public Address System 1. Specifications for lod speakers - IS:7741 (Part-I, II and III) 2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	3. Specification for Public Address Amplifiers - IS:10426. 4. Code of practice for outdoor installation of PA system - IS:1982. 5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. 6. Basic environmental testing procedures for electronic and electrical items - IS:9000. 7. Characteristics and methods of measurements for sound system equipment - IS:9302 8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732 9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) 10. Fittings for rigid steel conduits for electrical wiring - IS:2667 11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System 1. API 670 - 1994 2. BS : 4675 Part-2			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS	PAGE 75 OF 83	

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT :
		ITEM :	QP NO.: REV.NO.: DATE: PAGE: OF....	PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		SUB-SYSTEM:		

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.		11.

		LEGEND: * RECORDS, IDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN “N” AS ‘ W”	 FOR NTPC USE	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

FORMAT NO.: QS-01-QAI-P-09/F1-R1

1/1

ENGG. DIV./QA&I

KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENT	PAGE 76 OF 83
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SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV. NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PAGE: OF....	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)		DOC. NO.:			REV.....		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER								
SIGNATURE				FOR NTPC USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL		

FORMAT NO.: QS-01-QAI-P-09/F2-R1

1/1

ENGG. DIV./QA&I

KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENT	PAGE 77 OF 83
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ANNEXURE-III

	Project :	Stage ::	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL						DOC. NO.:	
	Package :								REV. NO.:	
	Supplier :		SUB-SYSTEM :						DATE :	
	Contractor No. :								PAGE : OF	
S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter “A” in the list alongwith the condition of approval, if any.

DR – For these items “Detailed required” for NTPC review. To be identified with letter “DR” in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with “NOTED.”

QP/INSPN CATEGORY:

CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

FORMAT NO.: QS-01-QAI-P-1/F3-R0

1/1

Engg. Div. / QA&I

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ANNEXURE-IV

	Project :	Stage ::	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL						DOC. NO.:			
	Package :								REV. NO.:			
	Contractor :								DATE :			
	Contractor No. :								PAGE : OF			
S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-mission	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks	
FORMAT						1/1	Engg. Div. / QA&I					

ANNEXURE-V

		Project :		Stage :		FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code:							DOC. NO.:			
		Contractor :											REV. NO.:			
		Contractor No. :				DATE :										
		System :				PAGE : OF										
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	
NOTES:																
SIGNATURE																
FORMAT						1/1						Engg. Div. / QA&I				

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			एनटीपीसी NTPC																																																								
	<table><tr><th>S.No</th><th>Description of Drgs/Docs</th><th>No of Prints</th><th>No of CD ROMs/DVDs/Portable Hard Disk</th></tr><tr><td rowspan="8">1</td><td>Drawings, Data sheets, Design calculations, Purchase specifications and other documents</td><td></td><td></td></tr><tr><td>First submission and submission with major changes</td><td></td><td></td></tr><tr><td>▪ Layout (A0&A1 sizes)</td><td>4</td><td>-</td></tr><tr><td>▪ Other Drawings/Documents (A0&A1 sizes)</td><td>2</td><td>-</td></tr><tr><td>▪ P&ID (All sizes)</td><td>4</td><td>-</td></tr><tr><td>a) Final drawings/documents (Directly to site)</td><td>6</td><td>2</td></tr><tr><td>b) “As Built” Drawing/Documents (Directly to site)</td><td>6</td><td>2</td></tr><tr><td>c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.</td><td>2</td><td>2</td></tr><tr><td>2</td><td>Erection Manual (Directly to site)</td><td>4 sets</td><td>2</td></tr><tr><td rowspan="2">3</td><td>Operation & Maintenance manual</td><td rowspan="2">1 set</td><td rowspan="2">--</td></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td>2</td></tr><tr><td rowspan="2">4</td><td>Plant Hand Book</td><td rowspan="2">1</td><td rowspan="2">1</td></tr><tr><td>i) First Submission</td></tr><tr><td rowspan="2">5</td><td>Commissioning and Performance Test Procedure manual</td><td rowspan="2">1 set</td><td rowspan="2">--</td></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td>2</td></tr></table>				S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents			First submission and submission with major changes			▪ Layout (A0&A1 sizes)	4	-	▪ Other Drawings/Documents (A0&A1 sizes)	2	-	▪ P&ID (All sizes)	4	-	a) Final drawings/documents (Directly to site)	6	2	b) “As Built” Drawing/Documents (Directly to site)	6	2	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2	2	Erection Manual (Directly to site)	4 sets	2	3	Operation & Maintenance manual	1 set	--	i) First Submission		ii) Final Submission (Directly to site)	4 sets	2	4	Plant Hand Book	1	1	i) First Submission	5	Commissioning and Performance Test Procedure manual	1 set	--	i) First Submission		ii) Final Submission (Directly to site)	4 sets	2
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KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-2600-001-9	GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 81 OF 83																																																								

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)				
	S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	
	6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--	
		ii) Approved Copies (Direct to Site)	4 sets	2	
	7	Project Completion Report (Directly to site)	6 sets	2	
	8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	--	
	9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	--	
	10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc			
		i) For review/comment	1	--	
		ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2	
	11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals			
		i) For review/comment	1 set	--	
		ii) Approved copies (Direct to Site)	4 sets	2	
	12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2	
13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2		
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PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
WTE	Layout & model of WtE area, cable & piping trestles etc. WTE • Mass balance, Design, selection and sizing calculations of WtE • Training on factors affecting sizing/ efficiency of WtE system, equipments & auxiliaries • Materials for WtE & selection • Basic concepts, Design and sizing calculations on grate, feed hopper, hydraulic grab, grate drive system, Sfans, bag filter, flue gas treatment, SCR, SNCR, hydraulic pusher, ash handling systems, emission control systems, emission measurement systems including piping, valves, etc.. • WtE electrical system • WtE control system Erection strategies, erection procedures Performance as per applicable code and demonstration tests.	Familiarization with various system and equipment Performance, data collection analysis and review O&M feed back Operation history of various equipments and system Failure analysis	Manufacturing process of Absorber and equipments Welding process Testing facilities Product development in process Future plan for technology induction R&D work in progress	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues. Familiarization of special maintenance techniques Special tool and tackles familiarization
MAN MONTH	2	0.5	0.5	6
KAWAS WTE PROJECT (2X350 TPD) EPC PACKAGE TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC. NO.: CS-2600-001-9 GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VII PAGE 83 OF 83				

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
WASTE TO ENERGY PROJECT AT KAWAS, SURAT**

PART - D

ERECTION CONDITIONS OF CONTRACT

SECTION – VI

TECHNICAL SPECIFICATION

BID DOC. NO.: CS-2600-001-9

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
WASTE TO ENERGY PROJECT AT KAWAS, SURAT**

PART - D

ERECTION CONDITIONS OF CONTRACT

SECTION – VI

TECHNICAL SPECIFICATION

BID DOC. NO.: CS-2600-001-9

(This document is meant for the exclusive purpose of bidding against this Package and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

PART - D

ERECTION CONDITIONS OF CONTRACT

ERECTION CONDITIONS OF CONTRACT



PART - D

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1.00.00	GENERAL			
1.01.00	The following provisions shall supplement the conditions already contained in the other parts of these specifications and documents and shall govern that portion of the work of this contract which is to be performed at site. The erection requirements and procedures not specified in these documents shall be in accordance with the recommendations of the equipment manufacturer, or as mutually agreed to between the Employer and the Contractor prior to commencement of erection work.			
1.02.00	The Contractor upon signing of the Contract shall, in addition to a Project Co-ordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and co-ordination of the Works to be performed at Site. Such a person shall function from the Site office of the Contractor during the pendency of Contract.			
2.00.00	REGULATION OF LOCAL AUTHORITIES AND STATUTES			
2.01.00	In addition to the local laws and regulations, the Contractor shall also comply with the Minimum Wages Act and the Payment of Wages Act (both of the Government of India) and the rules made there under in respect of its labour and the labour of its sub-contractors currently employed on or connected with the contract.			
2.02.00	All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully pay-able under the provisions of the Indian Boiler Regulations and any other statutory laws and its amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the Employer, shall be to the account of the Employer. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor or his Sub-Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor.			
3.00.00	WELDING OF PRESSURE PARTS AND HIGH PRESSURE PIPING			
	The welding of all pressure parts and high pressure piping shall be in accordance with the following requirements:			
3.01.00	Qualification of Weld Procedures			
	Only qualified welding procedures as per ASME Section IX shall be used by contractor at site. Procedure qualification records along with WPS shall be submitted to NTPC for review. Welding procedure shall indicate all essential and non-essential parameters as per ASME Section IX. Makes of welding consumables shall be subject to employer's approval.			
3.02.00	Welder's Qualification			
	Only welders who are qualified in accordance with the latest applicable requirements of the Indian Boiler Regulations, shall be permitted to perform any welding work on the pressure parts and its attachment welding. In addition to such statutory qualification requirements, the welders shall also undergo a satisfactory			
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3.03.00	pre-production qualification test to be conducted by the Contractor at site as per ASME Sec IX in presence of employer's representative(s), prior to performing work under these specifications. The services of an independent testing laboratory shall be retained by the Contractor to perform welder qualification tests for welders. All the welders carrying out welding at site shall carry an identification badge, which shall indicate the category and the grade of welding for which they have been tested and authorised to carry out welding.			
	Records Welders performance shall be monitored regularly and record of their performance shall be maintained by contractor in a manner acceptable to the employer. Contractor shall maintain such records including record of procedure qualification & welder qualification and hand-over to the employer at the end of work.			
	MARKING On completion of each welded joint, the welder shall mark his regularly assigned identification mark near the joint. The welder's identification numbers, inspection stamps or code symbol stamps and any other information shall not be directly stamped on any alloy steel piping. In alloy steel piping, all such information shall be stamped on separate marking plate which shall be tack welded on pipe near the weld.			
	HEAT TREATMENT Pre-heating, post-heating and post-weld stress relief operations of all welds, shall be performed in accordance with the requirements of applicable code. Local post weld stress relieving heat treatments shall be adopted only in cases where it is normally impracticable to subject the entire assembly as such for stress relieving operations. Heating may be by means of electric induction coils or electric resistance coils. Oxy-acetylene flame heating or exothermic chemical heating methods will not be permitted. Complete recording of the temperatures through out the stress relieving cycle of the material and the weld subjected to heat treatment shall be made by means of a potentiometric recorder. Recorders other than those of potentiometric type shall not be used for such temperature recording during stress relieving operations. The contractor & employer's representative, at start and at the end of HT Cycle shall sign the time and temperature charts for heat-treatment. Not Used. After setting up the weld joint for heat treatment operation, the Employer's signature shall be obtained on the strips chart of the recorder prior to starting of heat treatment cycle. The right hand corner of the strip chart at the starting point of the heat treatment cycle shall contain details like the weld number, material, diameter and thickness, method of heating adopted, prescribed ranges of heat treatment temperatures, date of heat treatment, reference to item number of the Field welding Schedule (as specified at clause no 7.00.00- of this chapter) etc.			
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5.00.00	WELD EDGE PREPARATION Preparation at site of weld joint shall be in accordance with details acceptable to the Employer. Wherever possible, machining or automatic flame cutting shall be used for edge preparation. Hand flame cutting will be permitted only where edge preparation otherwise is impractical. All slag shall be removed from cuts and all the hand cuts shall be ground smooth to the satisfaction of the Employer. Flame cutting of alloy steel pipe shall be avoided. Wherever such cutting is done, a 200mm length at the cut face shall be removed by machining. Pneumatic hand tools such as edge preparation, tube cutting machine can be used.			
6.00.00	CLEANING AND SERVICING			
6.01.00	The inside of all tubes, pipes, valves and fittings shall be free from dirt, and loose scales before being erected. All the pipelines shall be thoroughly blown and/or flushed. Each steam and water tubes shall be blown with compressed air and shall be subjected to 'ball test' before erection to ensure that no obstructions exist. A system for recording of all such operations shall be developed and maintained in a manner to ensure that no obstructions are left inside the tubes and no tubes are left uncleaned and untested.			
6.02.00	All valves and valve actuators, and dampers and damper actuators, if any, shall be thoroughly cleaned and serviced prior to pre-commissioning tests and/or Initial Operations of the plant. A system for recording of such servicing operation shall be developed and maintained in a manner acceptable to the Employer and to ensure that no valves or dampers including their actuators are left unserviced.			
6.03.00	All interior surfaces of the turbine shall be thoroughly cleaned prior to boxing - up to remove all traces of oil preservations.			
7.00.00	FIELD WELDING SCHEDULE The Contractor shall submit to the Employer, a certified and complete field welding schedule for all the field welding activities to be carried out in respect of the pressure parts involved in the equipment furnished and erected by him, at least 90 days prior to the scheduled start of erection work at site. Such schedule will be strictly followed by the Contractor during the process of erection. The above field-welding schedule to be issued by the Contractor shall contain the following: (a.) Drawing No (s) (b.) Location of the weld (c.) Size of the weld (outside diameter and thickness) (d.) Type of joints (e.) Material specifications (f.) Size of fillet on backing ring, when the type of joint is with backing ring (g.) Electrode/ filler metal specifications			
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	(h.) Number of welds per unit (i.) Quantity of filler metal per weld (j.) Indication of required Non-destructive Examination (NDE) for each weld (k.) Pre-heat temperatures for welding (l.) Process of welding (m.) Post-welding heat treatment temperature ranges, duration, under as specified at clause no 4.00.00 of this chapter entitled "Heat Treatment". (n.) Qualification details of weld procedures to be adopted as specified at clause no 3.01.00 of this chapter entitled 'Qualification of Weld Procedures'.			
8.00.00	SITE RUN MISCELLANEOUS PIPING Sketches or diagrams of the proposed routings of all piping, not already indicated and routed on the shop drawings which were reviewed by the Employer, shall be submitted to the Employer for review, Employer's acceptance of such site routings shall be obtained before the piping is erected. All these site run piping shall be installed in such a manner as to present an orderly and neat installation. They shall be located as to avoid obstruction of access and passages. Valves, instruments or any other special items shall be located convenient for operation by the operating personnel. Pipe runs shall be plumb or level except where pitch for drainage is required. Pipe runs that are not parallel to the building structure, walls or column rows shall be avoided so that deflection of pipes between hangers does not exceed 6 mm. No miscellaneous pipe shall be routed and installed above or adjacent to electrical equipment.			
9.00.00	THERMAL EXPANSIONS All piping installation shall be such that no excessive or destructive expansion forces exist either in the cold condition or under condition of maximum temperature. All bends, expansion joints and any other special fittings, necessary to provide proper expansion, shall be incorporated. During installation of expansion joints and anchors, care must be taken to make sure that full design movement is available at all times for maximum to minimum temperature and vice-versa.			
10.00.00	PIPING SUPPORTS			
10.01.00	Hangers, supports and anchors shall be installed as required to obtain a safe, reliable and complete pipe installation. All supports shall be properly levelled and anchored when installed. The anchors shall be so placed that thermal expansion will be absorbed by bends without subjecting the valves or equipment to excessive strains.			
10.02.00	The hanger assemblies shall not be used for the attachment of rigging to hoist the pipe into place. Other means shall be used to securely hold the pipe in place till the pipe support is completely assembled and attached to the pipe and building			
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	structures and spring support is set to accommodate the pipe way. All temporary rigging shall be removed in such a way that the pipe support is not subjected to any sudden load. All piping, having variable spring type supports, shall be held securely in place by temporary means during the hydraulic test of pipe system. Constant support type spring hangers used during hydraulic test shall be pinned or blocked solid during the test. After complete installation and insulation of the piping and filling of the piping with its normal operating medium, the pipe support springs shall be adjusted to the cold positions. If necessary, the spring support shall be re-adjusted to the hot positions after the line has been placed for service at its normal maximum operating temperature conditions. Electric arc welding only shall be used to weld all pipe supports to structural steel members that form part of the building supporting structure. The structural beams shall not be heated more than necessary during welding of supports and such welds shall run parallel to the axis of the span. All lugs or any other attachments welded to the piping shall be of the same material as the pipe.			
11.00.00	PRESSURE TESTING			
11.01.00	On completion of erection of pressure parts, a hydraulic test in accordance with the requirements of the Indian Boiler Regulations shall be performed by the Contractor.			
11.02.00	All the valves, high pressure pipes and inter-connected pipes connecting the pressure parts shall be tested along with pressure parts. All blank flanges or any removable plugs required for openings not closed by the valves, and piping provided, shall be furnished by the Contractor. The pressurization equipment including water piping from the supply, needed for the above test shall also be furnished by the Contractor. Any defects noticed during the testing are to be rectified and the unit re-tested. If any welding is done on the pressure parts after the Hydraulic test, the Hydraulic test for that portion of pressure parts shall be repeated. Water as required for such pressure testing shall be provided by the employer.			
11.03.00	Thy hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting Authority as per the provisions of the Indian Boiler Regulations and the Employer.			
12.00.00	THERMOWELLS AND FLOW NOZZLES			
12.01.00	All the thermowells and flow nozzles in the equipment furnished under the technical specifications shall be installed as a part of this work.			
12.02.00	All thermowell connections incorporated in the steam service shall be plugged during the pressure testing and the blow out of steam piping systems. Upon completion of the blow out operation, all thermowells shall be installed and seam welded. Similarly, all flow nozzles in the steam lines shall also be installed only on completion of steam blowing operations unless otherwise agreed to by the Employer, depending upon the sequence of cleaning and purging operations to be adopted by the Contractor at the field.			
13.00.00	INSULATION, LAGGING AND CLADDING The provision of insulation, lagging and cladding of the various equipments and portion of the equipment covered under the Contract, shall be furnished by the			
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13.01.00	Contractor as specified elsewhere or agree to separately in writing. Welds required for holding insulation on pressure parts shall be carried out by IBR qualified welder. Piping, Pipe Fittings & Valves All piping insulation and metal cladding furnished with the equipment to be erected shall be applied as specified herein.			
13.01.01	Piping The insulation on piping shall be applied using wire loops on 150mm centres. These wire loops shall be thoroughly embedded into the outer insulation surface and all cracks, voids and depressions shall be filled with insulating cement suitable for the piping temperature so as to form a smooth base for application of cladding. The wires used for piping insulation shall be of 16 SWG. The surface shall be smooth and uniform before applying the outer covering. All piping insulation ends shall be terminated at a sufficient distance from flanges to facilitate removal of bolts.			
13.01.02	Flanges Insulation on flanges shall be by means of blocks of insulating material securely bound to the flange by wire loops. Such blocks of insulation shall be long enough to overlap the adjacent pipe insulation by an amount equal to the thickness of adjacent pipe insulation. Smooth finish shall be obtained by the application of insulating cement. Alternatively, sectional pipe insulation of proper diameter may be used. Insulation on flanges shall not be done until the pipe and equipment have been in service during the initial operation and till all the flange bolts have been retightened.			
13.01.03	Bends and Elbows Insulation on bends and elbows shall be cut into sections sufficiently short to form a reasonable smooth external surface. After the application of insulation material in place, it shall be smoothly coated with insulating cement. Elbows may be insulated as above or alternatively by means of specially moulded insulation enclosures.			
13.01.04	Cladding Cladding shall be of aluminium sheet of thickness as per details given in detail Technical Specification or will be provided during detail engineering shall be machine rolled and formed to accurately fit insulation curvatures. Cladding shall be secured using self-tapping screws. Screws shall be adequate number and so located as to produce tight joints. The spacing of screws shall be as far as possible uniform and on centres not exceeding 150 mm. For outside diameters less than 230 mm, spacing of screws shall be on centres not exceeding 100 mm. adequate number of screws shall be provided for fixing the cladding and be so placed in such locations, as to produce a smooth cladding finish without bellying'. Insulated elbows having insulated diameters less than 330 mm shall be provided with preformed smooth aluminium elbow jackets. Wherever possible, all joints should be lapped a minimum of 50 mm with joints facing downwards and so placed that they are obscured from normal points of vision. All the joints in the cladding shall be made with suitable provisions for expansions. All butt joints such as those at piping tees			
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13.01.05	shall be made using rolled seams. In addition, to prevent galvanic corrosion, suitable action, as specified at clause no 13.02.00 of this chapter, shall be taken. Valves and Fittings All valves and fittings (above valve size of 2 inches) installed in the steam pipelines shall also be applied with insulation and furnished with suitably shaped boxes so as to facilitate easy dismantling of the fittings. The insulation thickness for valves, valve fittings etc., shall be same as that used on the line on which they are installed. All voids shall be properly filled up with insulating material and as per the directions of the Employer.			
13.02.00	Protection of Equipment during Insulation Applications All equipment and structures shall be suitably protected from damage while applying insulation after completion of insulation. All equipment and structures shall be thoroughly cleaned and remove insulating materials which might have fallen on them.			
14.00.00	CODE REQUIREMENTS The erection requirements and procedures to be followed during the installation of the equipment shall be in accordance with the relevant Indian Electricity Rules & Codes, Indian Boiler Regulations, ASME codes and accepted good practices, the Employer's Drawings and other applicable Indian recognised codes and laws and regulations of the Government of India.			
15.00.00	ELECTRICAL SAFETY REGULATIONS			
15.01.00	In no circumstances will the Contractor interfere with fuses and electrical equipment belonging to the other Contractor or Employer.			
15.02.00	Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contractor or Employer, he shall: (a) Satisfy the Employer that the appliance is in good working condition. (b) Inform the Employer of the maximum current rating, voltage and phase of the appliances. (c) Obtain permission of the Employer detailing the socket to which the appliances may be connected. The Employer will not grant permission to connect until he is satisfied that (d) The appliance is in good condition and is fitted with suitable plug. (e) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.			
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15.03.00	No electric cable in use by the other Contractor/Employer will be disturbed without permission. No weight of any description will be imposed on any such cable and ladder or similar equipment will rest against or to be attached with it.			
15.04.00	No reapir work shall be carried out on any live equipment. The equipment must be declared safe by the Employer and a permit to work issued before any work is carried out.			
15.05.00	The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.			
16.00.00	REMOVAL OF MATERIAL No material brought to the Site shall be removed from the Site by the Contractor and/or his Sub-Contractors without the prior written approval of the Employer.			
17.00.00	INSPECTION, TESTING AND INSPECTION CERTIFICATES The provisions of the clause entitled Inspection, Testing and Inspection Certificates given in Part - C of the Technical Specification, shall also be applicable to the erection portion of the Works. The Employer shall have the right to re-inspect any equipment though previously inspected and approved by him at the Contractor's works, before and after the same are erected at Site. If by the above inspection, the Employer rejects any equipment, the Contractor shall make good for such rejections either by replacement or modification/ repairs as may be necessary to the satisfaction of the Employer. Such replacements will also include the replacements or re-execution of such of those works of other Contractors and/or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor's work.			
18.00.00	ACCESS TO SITE AND WORKS ON SITE			
18.01.00	Suitable access to site and permission to work at the Site shall be accorded to the Contractor by the Employer in reasonable time.			
18.02.00	In the execution of the Works, no person other than the Contractor or his duly appointed representative, Sub-Contractor and workmen, shall be allowed to do work on the Site, except by the special permission, in writing by the Employer or his representative.			
19.00.00	CONTRACTOR'S SITE OFFICE ESTABLISHMENT The Contractor shall establish a Office at the Site and keep posted an authorised representative for the purpose of the Contract. Any written order or instruction of the Employer or his duly authorised representative, shall be communicated to the said authorised resident representative of the Contractor and the same shall be deemed to have been communicated to the Contractor at his legal address.			
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20.00.00	CO-OPERATION WITH OTHER CONTRACTORS			
20.01.00	Employer, who may be performing other works on behalf of the Employer and the workmen who may be employed by the Employer and doing work in the vicinity of the works under the Contract. The Contractor shall also arrange to perform his work as to minimise, to the maximum extent possible, interference with the work of other Contracts and their workmen. Any injury or damage that may be sustained by the employees of the other Contractors and the Employer, due to the Contractor's work shall promptly be made good at his own expense. The Employer shall determine the resolution of any difference or conflict that may arise between the Contractor and other Contractors or between the Contractor and the workmen of the Employer in regard to their work. If the work of the Contractor is delayed because of the any acts of omission of another Contractor, the Contractor shall have no claim against the Employer on that account other than an extension of time for completing his works. Employer shall have full access to visit the contractor's site at any time for inspection and surveillance checks.			
20.02.00	The Employer shall be notified promptly by the Contractor of any defects in the other Contractor's works that could affect the Contractor's Works. The Employer shall determine the corrective measures if any, required to rectify this situation after inspection of the works and such decisions by the Employer shall be binding on the Contractor.			
21.00.00	DISCIPLINE OF WORKMEN			
	The Contractor shall adhere to the disciplinary procedure set by the Employer in respect of his employees and workmen at Site. The Employer shall be at liberty to object to the presence of any representative or employee of the Contractor at the Site, if in the opinion of the Employer such employee has misconducted himself or is incompetent, negligent or otherwise undesirable then the Contractor shall remove such a person objected to and provide in his place a competent replacement.			
22.00.00	CONTRACTOR'S FIELD OPERATION			
22.01.00	The Contractor shall keep the Employer informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the Employer shall not relieve the Contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Employer or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.			
22.02.00	The Contractor shall have the complete responsibility for the conditions of the Work-Site including the safety of all persons employed by him or his Sub-Contractor and all the properties under his custody during the performance of the work. This requirement shall apply continuously till the completion of the Contract and shall not be limited to normal working hours. The construction review by the Employer is not intended to include review of Contractor's safety measures in, on or near the Work-Site, and their adequacy or otherwise.			
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23.00.00	PHOTOGRAPHS AND PROGRESS REPORT			
23.01.00	The Contractor shall furnish three (3) prints each to the Employer of progress photographs of the work done at Site. Photographs shall be taken as and when indicated by the Employer or his representative. Photographs shall be adequate in size and number to indicate various stages of erection. Each photograph shall contain the date, the name of the Contractor and the title of the photograph.			
23.02.00	The above photographs shall accompany the monthly progress report detailing out the progress achieved on all erection activities as compared to the schedules. The report shall also indicate the reasons for the variance between the scheduled and actual progress and the action proposed for corrective measures, wherever necessary.			
23.03.00	The Contractor shall submit the progress of work in soft and hard form (as decided by employer) quarterly highlighting the progress and constraints at site.			
24.00.00	MAN-POWER REPORT			
24.01.00	The Contractor shall submit to the Employer, on the first day of every month, a man hour schedule for the month, detailing the man hours scheduled for the month, skill-wise and area-wise.			
24.02.00	The Contractor shall also submit to the Employer on the first day of every month, a man power report of the previous month detailing the number of persons scheduled to have been employed and actually employed, skill- wise and the areas of employment of such labour.			
25.00.00	PROTECTION OF WORK			
	The Contractor shall have total responsibility for protecting his works till it is finally taken over by the Employer. No claim will be entertained by the Employer or the representative of the Employer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings. Should any such damage to the Contractor's Works occur because of other party not being under his supervision or control, the Contractor shall make his claim directly with the party concerned. If disagreement or conflict or dispute develops between the Contractor and the other party or parties concerned regarding the responsibility for damage to the Contractor's Works the same shall be resolved as per the provisions of the as specified at clause no 21.00.00 of this chapter entitled "Co-operation with other Contractors." The Contractor shall not cause any delay in the repair of such damaged Works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.			
26.00.00	EMPLOYMENT OF LABOUR			
26.01.00	In addition to all local laws and regulations pertaining to the employment of labour to be complied with by the Contractor pursuant to GCC, the Contractor will be expected to employ on the work only his regular skilled employees with experience of the			
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26.02.00 26.03.00 26.04.00 26.05.00 27.00.00 27.01.00 27.02.00 27.03.00 27.04.00	particular work. No female labour shall be employed after darkness. No person below the age of eighteen years shall be employed. All travelling expenses including provisions of all necessary transport to and from Site, lodging allowances and other payments to the Contractor's employees shall be the sole responsibility of the Contractor. The hours of work on the Site shall be decided by the Employer and the Contractor shall adhere to it. Working hours will normally be eight (8) hours per day - Monday through Saturday. Contractor's employees shall wear identification badges while on work at Site. In case the Employer becomes liable to pay any wages or dues to the labour or any Government agency under any of the provisions of the Minimum Wages Act, Workmen Compensation Act, Contract Labour Regulation Abolition Act or any other law due to act of omission of the Contractor, the Employer may make such payments and shall recover the same from the Contractor's Bills. FACILITIES TO BE PROVIDED BY THE EMPLOYER Electricity Bidder shall make his own arrangement to meet the construction power requirement of the project. 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. Raw water intake location is marked in GLP. Raw water shall be drawn from intake location for waste to energy plant. Communication Contractor shall make all arrangements himself at his own cost. Space The contractor shall advice the employer with in thirty(30) days from the date of acceptance of the Notification of Award about his exact requirement of space for his office, storage area, pre-assembly and fabrication areas etc., The above requirement shall be reviewed by the Employer and the space as decided by Employer will be allotted to the contractor for construction of his temporary structures/facilities like office, storage sheds, pre assembly and fabrication areas etc. for contractor's as well as his sub-contractor's use. Land for staff and labour colony shall not be provided by the owner and the contractor has to make his own arrangement for the same at his own cost.			
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28.00.00 28.01.00 28.02.00 28.03.00 28.04.00 28.05.00 28.05.01 28.05.02 28.06.00 28.06.01 28.06.02	FACILITIES TO BE PROVIDED BY THE CONTRACTOR Contractor's site office Establishment The Contractor shall establish a site office at the site and keep posted an authorized representative for the purpose of the contract, pursuant to GCC. The site office will include one conference meeting room for site meetings between the Contractor and the Employer. Tools, tackles and scaffoldings The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, installation, testing, commissioning and conducting Guarantee tests of the equipments covered under the Contract. He shall submit a list of all such materials to the Employer before the commencement of pre-assembly at Site. These tools and tackles shall not be removed from the Site without the written permission of the Employer. The Contractor shall arrange Dozer, Hydra, Cranes, Trailer, etc. for the purpose of fabrication, erection and commissioning. Testing Equipment and Facilities: The contractor shall provide the necessary testing, equipment and facilities. Site laboratory for civil works: Contractor shall provide and maintain a site laboratory for the testing of construction material under the direction and general supervision of employer. First-aid The Contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site. Enough number of Contractor's personnel shall be trained in administering first-aid. The Employer will provide the Contractor, in case of any emergency, the services of an ambulance for transportation to the nearest hospital. Cleanliness The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of Contract. The Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by the Employer. Materials and stores shall be so arranged to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage. Similarly the offices shall be kept clean and neat to the entire satisfaction of the Employer. Proper sanitary arrangements shall be provided by the Contractor, in the work-areas and office areas of the Contractor.			
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29.00.00	LINES AND GRADES All the Works shall be performed to the lines, grades and elevations indicated on the drawings. The Contractor shall be responsible to locate and layout the Works. Basic horizontal and vertical control points will be established and marked by the Employer at Site at suitable points. These points shall be used as datum for the works under the Contract. The Contractor shall inform the Employer well in advance of the times and places at which he wishes to do work in the area allotted to him so that suitable datum points may be established and checked by the Employer to enable the Contractor to proceed with his works. Any work done without being properly located may be removed and/or dismantled by the Employer at Contractor's expense.			
30.00.00	FIRE PROTECTION			
30.01.00	The work procedures that are to be used during the erection shall be those which minimise fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the Site at least once each day. Fuels, oils and volatile or flammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Untreated canvas, paper, plastic or other flammable flexible materials shall not at all be used at Site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the Site, the same shall be removed and replaced with acceptable material before moving into the construction or storage area.			
30.02.00	Similarly corrugated paper fabricated cartons etc. will not be permitted in the construction area either for storage or for handling of materials. All such materials used shall be of water proof and flame resistant type. All the other materials such as working drawings, plans etc. which are combustible but are essential for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.			
30.03.00	All the Contractor's supervisory personnel and sufficient number of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the Contract.			
30.04.00	The Contractor shall provide enough fire protection equipment of the types and number for the warehouses, office, temporary structures, labour colony area etc. Access to such fire protection equipment, shall be easy and kept open at all time.			
31.00.00	SECURITY The Contractor shall have total responsibility for all equipment and materials in his custody stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss. All materials of the Contractor shall enter and leave the Employer Site only with the written permission of the Employer in the prescribed manner.			
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32.00.00	CONTRACTOR'S AREA LIMITS The Employer will mark-out the boundary limits of access roads, parking spaces, storage and construction areas for the Contractor and the Contractor shall not trespass the areas not so marked out for him. The Contractor shall be responsible to ensure that none of his personnel move out of the areas marked out for his operations. In case of such a need for the Contractor's personnel to work out of the areas marked out for him the same shall be done only with the written permission of the Employer.			
33.00.00	CONTRACTOR'S CO-OPERATION WITH THE EMPLOYER In case where the performance of the erection work by the Contractor affects the operation of the system facilities of the Employer, such erection work of the Contractor shall be scheduled to be performed only in the manner stipulated by the Employer and the same shall be acceptable at all times to the Contractor. The Employer may impose such restrictions on the facilities provided to the Contractor such as electricity, etc. as he may think fit in the interest of the Employer and the Contractor shall strictly adhere to such restrictions and co-operate with the Employer. It will be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems which are erected by him. The Contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment furnished and installed by him, so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in documents and specifications.			
34.00.00	PRE-COMMISSIONING AND COMMISSIONING ACTIVITIES			
34.01.00	GENERAL			
34.01.01	The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the equipment/systems ready for safe, reliable and efficient operation on sustained basis. All pre-commissioning/commissioning activities considered essential for such readiness of the equipment/systems including those mutually agreed and included in the Contractor's quality assurance programme as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the contractor.			
34.01.02	The pre-commissioning and commissioning activities including Guarantee/ demonstration/ acceptability tests, checks and trial operations of the equipment/systems furnished and installed by the contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at site during such operations.			
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34.01.03	The following activities shall be carried out by the contractor, 18 month prior to schedule date of commissioning of the equipment/systems installed by him. (a.) The contractor shall furnish the organization chart of his operation and commissioning engineers for the acceptance of employer. Adequate number of operation and commissioning engineers shall be deployed by the contractor to effectively meet the requirement of round the clock operation in shifts also, till the plant is taken over by the employer. (b.) The contractor shall submit the bio-data containing the details of experience of his operation and commissioning engineers for the acceptance of employer. (c.) The contractor shall furnish the deployment schedule of his operation and commissioning engineers for the acceptance of the employer. (d.) Apart from above, contractor shall ensure deployment of sufficient skilled/semi-skilled/unskilled manpower during pre-commissioning and commissioning activities.			
34.01.04	It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment/systems which are installed by him.			
34.01.05	The Contractor shall also be responsible for flushing and initial filling of all oils and lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications and documents.			
34.02.00	COMMISSIONING DOCUMENTATION			
34.02.01	The contractor shall submit the commissioning documentation, comprising of Standard checklists, pre-commissioning procedures, testing schedules, commissioning schedules and commissioning networks for various equipment/systems covered under the contract, for the approval of employer.			
34.02.02	Standard checklist, as the name suggests, shall be a fairly general documents, containing the list of all checks required to be carried out for similar and repetitive type of equipment to ensure consistent and thorough checking. An indicative list of such equipment is enclosed as Annexure I.			
34.02.03	The testing schedule is a document, designed for safe and systematic commissioning of individual equipment/sub-system (for example compressor etc.) Commissioning schedule is a document envisaged for commissioning of a system (for example Compressed Air system, Unit commissioning etc.). The testing/Commissioning schedule shall have a standard format in order to maintain consistency of presentation, content and reporting. A brief write up on the contents of the Testing Schedule/Commissioning Schedule is enclosed as Annexure-II.			
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34.02.04	The contractor shall submit the list of commissioning documentation to be submitted by him, along with their submission schedule for various equipment/systems covered under the contract, with in 6(six) month from the date of award of contract, for the acceptance of employer.			
34.02.05	The Contractor shall submit the commissioning documentation, for various equipment/covered under the contract, for the approval of employer, at least 18 months before the scheduled date of commissioning of the equipment/systems.			
34.03.00	COMMISSIONING ACTIVITIES			
34.03.01	Upon completion of pre-commissioning activities/tests, the contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carry out system checking and reliability trials on various parts of the facilities.			
34.03.02	Contractor shall carry out the checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified.			
34.03.03	Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.			
34.03.04	The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment of prior to that as the case may be.			
34.03.05	Other tests shall be conducted, if required by the Employer, to establish that the plant equipment are in accordance with requirements of the specifications.			
34.03.06	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all electrical and C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied and installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications.			
34.05.00	Initial Operation Upon completion of system checking/Tests as above and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation as stipulated in General Technical Requirements.			
35.00.00	MATERIALS HANDLING AND STORAGE			
35.01.00	All the equipments furnished under the Contract and arriving at Site shall be promptly received, unloaded and transported and stored in the storage spaces by the Contractor.			
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35.02.00	Contractor shall be responsible for examining all the shipment and notify the Employer immediately of any damage, shortage, discrepancy etc. for the purpose of Employer's information only. The Contractor shall submit to the Employer every week a report detailing all the receipts during the week. However, the Contractor shall be solely responsible for any shortages or damage in transit, handling and / or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.			
35.03.00	The Contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the Employer.			
35.04.00	All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc. shall be used for unloading and/or handling of the equipment without the specific written permission of the Employer. The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at Site.			
35.05.00	All electrical panels, controls gear, motors and such other devices shall be properly dried by heating before they are installed and energised. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.			
35.06.00	All the electrical equipment such as motors, etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values maintained by the Contractor. Such records shall be open for inspection by the Employer.			
35.07.00	The Contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before the equipment are installed.			
35.08.00	The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.			
35.09.00	All the materials stored in the open or dusty location must be covered with suitable weatherproof and flame-proof covering material wherever applicable.			
35.10.00	If the materials belonging to the Contractor are stored in areas other than those earmarked for him, the Employer will have the right to get it moved to the area earmarked for the Contractor at the Contractor's cost.			
35.11.00	The Contractor shall be responsible for making suitable indoor storage facilities to store all equipment which require indoor storage. Normally, all the electrical equipments such as motors, control gear, generators, exciters and consumables like			
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36.00.00 36.01.00 36.02.00 36.03.00 36.04.00 36.05.00 a)	electrodes, lubricants etc. shall be stored in the closed storage space. The Employer, in addition, may direct the Contractor to move certain other materials, which in his opinion will require indoor storage, to indoor storage areas which the Contractor shall strictly comply with. CONSTRUCTION MANAGEMENT The field activities of the Contractors working at Site, will be coordinated by the Employer and the Employer decision shall be final in resolving any disputes or conflicts between the Contractor and other Contractors and tradesmen of the Employer regarding scheduling and co- ordination of work. Such decision by the Employer shall not be a cause for extra compensation or extension of time for the Contractor. The Employer shall hold weekly meetings of all the Contractors working at Site, at a time and place to be designated by the Employer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Employer and shall strictly adhere to those decisions in performing his Works. In addition to the above weekly meeting, the Employer may call for other meeting either with individual Contractors or with selected number of Contractors and in such a case the Contractor if called, will also attend such meetings. Time is the essence of the Contract and the Contractor shall be responsible for performance of his works in accordance with the specified construction schedule. If at any time, the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such actions in writing to the Employer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action. The Employer shall however not be responsible for provision of additional labour and/or materials or supply or any other services to the Contractor except for the co- ordination work between various Contractors as set out earlier. Site management during construction phase till handing over of plant Bidder shall ensure that the plant site within the plant boundary is managed in a coordinated and professional way all through the construction phase till handing over of plant, ensuring safe, easy & unhindered working conditions and a healthy & hygienic working environment at site. He shall ensure the following measures at site while executing the project. 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			
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	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. b) 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. 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. c) Suitable onsite maintenance workshop for day to day breakdown maintenance heavy plant and equipment like batching plants, cranes, earth moving equipment, poclains, welding equipment etc. The workshop shall have stock of frequently needed spares and suitable repair facilities with experienced technicians/mechanics. A central test laboratory equipped with test equipment for routine tests like tests on soil, concrete, bricks, aggregates, welds etc with experienced staff shall be established at the start of the project itself. d) All office and covered store buildings of the bidder and its agencies shall be of prefab/ pre-engineered / porta cabin construction. Shabby semi finished constructions in brickwork/ GI / asbestos roof etc shall not be permitted. e) First aid facilities and amenities like rest rooms, suitable pre engineered toilets (separate for men and women), drinking water fountains/tanks, canteen, crèche for women workers shall be planned and established at the beginning of the project itself. These facilities shall be located distributed over the plant area to enable easy access by the construction workers and staff and shall be marked on the plant layout. Suitable treatment for toilet discharge, like bio digesters etc shall be planned and conventional septic tanks / soak pits etc shall be avoided. f) Proper lighting of all construction / erection areas. Bidder shall erect adequate number of high lighting masts in Waste to Energy plant area, office and store areas for lighting during night. DG sets of adequate capacity shall be provided for emergency backup. The street lighting along the roads shall also be prioritized along with road construction. g) Well planned and coordinated storage and movement of plant, equipment and construction materials. System wise / agency wise storage / laydown areas shall be planned and marked on the plant layout at the beginning itself. Bidder shall ensure that all its agencies comply to the areas allocated to them and follow the designated storage and movement plans. Adequate covered storage shall be constructed for storage of critical equipments like switchgears, MCCs, insulation etc. h) Proper access control for construction workers, staff and visitors. Bidder shall ensure that suitable electronic based gate pass system is in place from start of project itself to keep record and track of all workers, staff and visitors entering/exiting the plant premises shift wise on daily basis.			
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i) j) k) l) 37.00.00	Compliance to all safety requirements as specified elsewhere in the tender documents. Bidders shall establish a safety centre at the start of the project itself. It shall have a 24X7 manned safety control room in addition to a permanent safety equipment display room, separate training / lecture hall with AV facilities for safety training, store room with adequate stock of specified safety equipment, a first aid room and other amenities. Bidder shall install CCTV cameras at all strategic locations in the plant area which shall be linked to the safety control room. 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. 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. Provision of adequate shelters, water supply, sanitation and lighting in construction workers and staff camps. No camps for workers and staff shall be permitted within the plant premises and Bidder shall make separate arrangement outside the plant premises for locating and development of camps for construction workers and staff. The designated areas shall be suitably developed with infrastructure like roads, drains, water supply and sewerage and shall be free from water logging. Suitable low cost shelters will be provided for the workers. Complete area shall be secured by fencing and shall be provided adequate area lighting. Suitable waste disposal, shopping and recreation facilities will be developed in these camps. Contractor shall ensure that due importance is given to site management as discussed above and a detailed work plan considering the above aspects is finalized immediately after the award. A senior level executive shall be identified who shall be responsible for implementation of the work plan. Suitable format for progress reporting on site management plan shall be developed and made part of the project progress report. The progress on implementation of above work plan shall be reviewed along with project progress in the monthly project review meetings with owner. In case the progress on site management plan is unsatisfactory, Engineer-in-Charge may withhold upto 1% of the monthly running bill (for civil and site erection works) till such time the required progress is demonstrated. Incase in the opinion of Engineer-in-charge, bidder's actions on site management aspects is not adequate, Engineer-in-charge may get the relevant work executed through a separate agency and deduct the expenses incurred from Bidder's bill along with overheads @10 %. FIELD OFFICE RECORDS The Contractor shall maintain at his Site Office up-to- date copies of all drawings, specifications and other Contract Documents and any other supplementary data complete with all the latest revisions thereto. The Contractor shall also maintain in			
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38.00.00 38.01.00 38.02.00 38.03.00 39.00.00 39.01.00 39.02.00	addition the continuous record of all changes to the above Contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other Engineering data to indicate as installed conditions of the equipment furnished and erected under the Contract. Such drawings and Engineering data shall be submitted to the Employer in required number of copies. CONTRACTOR'S MATERIALS BROUGHT ON TO SITE The Contractor shall bring to Site all equipment, components, parts, materials, including construction equipment, tools and tackles for the purpose of the Works under intimation to the Employer. All such goods shall, from the time of their being brought vest in the Employer, but may be used for the purpose of the Works only and shall not on any account be removed or taken away by the Contractor without the written permission of the Employer. The Contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto. The Employer shall have a lien on such goods for any sum or sums which may at any time be due or owing to him by the Contractor, under, in respect of or by reasons of the Contract. After giving a fifteen (15) days notice in writing of his intention to do so, the Employer shall be at liberty to sell and dispose off any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid. After the completion of the Works, the Contractor shall remove from the Site under the direction of the Employer the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the Employer. If the Contractor fails to remove such materials, within fifteen (15) days of issue of a notice by the Employer to do so then the Employer shall have the liberty to dispose off such materials as detailed under as specified at clause no 39.02.00 of this chapter and credit the proceeds thereto to the account of the Contractor. PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of the Employer and the employees of other Contractors and Sub- Contractors and all public and private property including structures, building, other plants and equipments and utilities either above or below the ground. The Contractor will ensure provision of necessary safety equipment such as barriers, sign - boards, warning lights and alarms, etc. to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the Employer and the Employers of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his Works and shall make all necessary arrangements with such Employers, related to removal and/or replacement or protection of such property and utilities.			
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40.00.00 PAINTING For painting refer Part-A, sub section-III, Section VI of Technical specification. Painting for structures shall conform to the painting specification specified in Part-B under Civil. Painting for Electrical equipments/systems shall conform to the painting specification given in Electrical portion of Part-A and Part-B of technical specifications. 41.00.00 INSURANCE 41.01.00 In addition to the conditions covered under the Clause entitled "Insurance" in Section General Conditions of Contract (GCC), the following provisions will also apply to the portion of works to be done beyond the Contractor's own or his Sub-Contractor's manufacturing Works. 41.02.00 Workmen's Compensation Insurance This insurance shall protect the Contractor against all claims applicable under the Workmen's Compensation Act, 1948 (Government of India). This policy shall also cover the Contractor against claims for injury, disability disease or death of his or his Sub-Contractor's employees, which for any reason are not covered under the Workmen's Compensation Act, 1948. The liabilities shall not be less than the following: Workmen's Compensation - As per Statutory Provisions Employee's Liability - As per Statutory Provisions 41.03.00 Comprehensive Automobile Insurance This insurance shall be in such a form to protect the Contractor against all claims for injuries, disability, disease and death to members of public including the Employer's men and damage to the property of other arising from the use of motor vehicles during on or off the Site operations, irrespective of the Ownership of such vehicles. The liability covered shall be as herein indicated : Fatal Injury : Rs.100,000 each person : Rs.200,000 each occurrence Property Damage : Rs.100,000 each occurrence 41.04.00 Comprehensive General Liability Insurance				
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41.04.01	The insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members of public or damage to property of others, due to any act or omission on the part of the Contractor, his agents, his employees, his representatives and Sub-Contractors or from riots, strikes and civil commotion. This insurance shall also cover all the liabilities of the Contractor arising out of the Clause entitled "Defence of Suits" in Section General Conditions of Contract (GCC).			
41.04.02	The hazards to be covered will pertain to all the Works and areas where the Contractor, his Sub-Contractors, his agents and his employees have to perform work pursuant to the Contract.			
41.05.00	The above are only illustrative list of insurance covers normally required and it will be the responsibility of the Contractor to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the Contract.			
42.00.00	UNFAVOURABLE WORKING CONDITIONS The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects during inclement weather conditions, like monsoon, storms, etc. and during other unfavourable construction conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the Contractor in a proper and satisfactory manner in the performance of such Works and with the concurrence of the Employer. Such unfavourable construction conditions will in no way relieve the Contractor of his responsibility to perform the Works as per the schedule.			
43.00.00	PROTECTION OF MONUMENTS AND REFERENCE POINTS The Contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc. which he may come across during the course of performance of his Works either during excavation or elsewhere, are properly protected and handed over to the Employer. Similarly the Contractor shall ensure that the bench marks, reference points, etc., which are marked either with the help of Employer or by the Employer shall not be disturbed in any way during the performance of his Works. If, any work is to be preformed which disturb such reference, the same shall be done only after these are transferred to other suitable locations under the direction of the Employer. The Contractor shall provide all necessary materials and assistance for such relocation of reference points etc.			
44.00.00	WORK & SAFETY REGULATIONS			
44.01.00	General i) The contractor shall comply with all the requirements of "The Building and Other Construction Workers (Regulation of Employment & Conditions of Service) Act," 1996 and its Central Rule 1998 / State Rules and any other statutory requirements as applicable.			
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	ii) The Contractor shall follow NTPC Safety Rules (displayed on NTPC website http://www.ntpctender.com) as issued from time to time with respect to safety in construction & erection. iii) The contractor shall have the approved Safety, Health and Environment (SHE) Policy in respect of Safety and health of Building Workers and it shall be circulated widely and displayed at conspicuous place in Hindi and local language understood by the majority of the workers. A copy of the safety policy should be submitted to Engineer in charge. iv) The contractor shall submit the safety plan comprising of methods to implement the Safety Policy/ Rules, Risk assessment and ensuring Safety at work areas, Safety audits, inspections and its compliance, Supervision and responsibility to ensure Safety at various levels, Safety training to employees, review of Safety and accident analysis, ensure Health and Safety Procedures to prevent accidents to Engineer I/c for approval as per the format of Safety plan as annexed at Annexure - III. v) The Contractors shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to the Employer or to others, working at the Site. vi) All equipments used in construction and erection by the contractor shall meet BIS / International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipments shall be strictly operated and maintained by the contractor in accordance with manufacturer's operation manual. The contractor should also follow Guidelines / Rules of the Employer in this regard. vii) The Contractors shall provide suitable latest Personal Protective Equipments of prescribed standard to all their employees and workmen according to the need. The Engineer I/c shall have the right to examine these safety equipments to determine their suitability, reliability, acceptability and adaptability. The contractor should also ensure these before their use at worksite. viii) The Contractor shall provide safe working conditions to all workmen and employees at his workplace including safe means of access, railings, stairs, and ladders, scaffolding, work platforms, toe boards etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection of scaffolds, access, work platforms etc. shall be good and the contractor shall use standard quality of material. ix) The Contractor shall follow and comply with all the Safety Rules, standards, code of practices of NTPC and relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any protest or contest or reservation. In case of any unconformity between statutory requirement and the Safety Rules of the Employer referred above, the latter shall be binding on the Contractor unless the statutory provisions are more stringent. As and when required he can refer / obtain copy of NTPC safety documents as stated above.			
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	x) The contractor shall have his own arrangements with nearby hospitals for shifting and treatment of sick and injured. The medical examination of the workers employed in hazardous areas shall be conducted as per Rule 223 Of The Building and Other Construction Worker (Regulation of Employment and Condition of Service) Central Rule 1998 Their health records shall be maintained accordingly and to be submitted to Engineer I/c when asked for. If any worker found suffering from occupational health hazard, the worker should be shifted to suitable place of working and properly treated under intimation to Engineer I/c. The medical fitness certificate to be submitted to Engineer (I/c). xi) First Aid boxes equipped with requisite articles as specified in the Rule 231 of The Building and Other Construction Worker (Regulation of Employment and Condition of Service) Central Rule 1998 shall be provided at construction sites for the use of workers. Training has to be provided on first aid to workmen & office bearers working at site.			
44.01.01	Emergency Action Plan The contractor shall prepare an emergency action plan approved by his competent authority to handle any emergency occurred during construction work. Regular mock drills shall be organized to practice this emergency plan. The Emergency Action Plan should be widely circulated to all the employees and suitable infrastructure shall be provided to handle the emergencies.			
44.01.02	Scaffolding The contractor shall take all precautions to prevent any accidental collapse of scaffolding or fall of persons from scaffolding. The contractor should ensure that scaffolding are designed by a competent person and its erection and repairs should be done under the expert supervision. The scaffolding shall meet the required strength and other requirements for the purpose for which the scaffold is erected. The material used for scaffold should conform to the BIS / International standards.			
44.01.03	Opening The contractor shall ensure that there is no opening in any working platform/any floor of the building, which may cause fall of workers or material. When ever an opening on a platform/any floor of the building is unavoidable, the opening should be suitably fenced and necessary measures for protection against falling objects or building workers from such platform are taken by providing suitable safety nets, safety belts or other similar means.			
44.01.04	Explosives The contractor shall take all precautions while handling, using, storing or transporting of all explosives. Before usage of any explosive necessary warning / danger signals be erected at conspicuous places to warn the workers and general public. The contractor should strictly ensure that all measures and precautions			
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	required to be complied for use, handling, storing or transportation of explosives under the rules framed under the Explosives Act, 1884.			
44.02.00	Fencing of Machinery	The contractor shall provide suitable fencing or guard to all dangerous and moving parts of machinery.		
		The contractor shall not allow any of the employees to clean, lubricate, repair, adjust or examine during machinery in motion, which may cause injury to the person.		
44.03.00	Carrying of Excessive Weight by a Worker	The worker shall not be allowed to lift by hand or carry over his head, back or shoulder more than the maximum limit set by the prescribed rules for the construction Workers.		
44.04.00	Dangerous and Harmful Gases / Equipment	The contractor shall ensure that the workers are not exposed to any harmful gases during any construction activity including excavation, tunneling, confined spaces etc.		
		The contractor should not allow any worker to go into the confined space unless it is certified by Engineer (I/c) to be safe and fit for the entry to such work place. Proper record and work permits should be followed to carry out such works.		
44.05.00	Overhead Protection	The contractor shall ensure that any area exposed to risk of falling materials, articles or objects is roped off or cordoned off or otherwise suitably guarded from inadvertent entry of any person.		
		Wherever there is a possibility of falling of any material, equipment or construction workers while working at heights, a suitable and adequate safety net should be provided. The safety net should be in accordance with BIS Standards.		
44.06.00	Working at Heights	All working platforms, ways and other places of construction work shall be free from accumulations of debris or any other material causing obstructions and tripping.		
		Wherever workers are exposed to the hazard of falling into water, the contractor shall provide adequate equipment for saving the employees from drowning and rescuing from such hazards. The contractor shall provide boat or launch equipped with sufficient number of life buoys, life jackets etc. manned with trained personnel at the site of such work.		
		Every opening at elevation from ground level through which a building worker, vehicle, material equipment etc. may fall at a construction work shall be covered and/or guarded suitably by the contractor to prevent such falls.		
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44.07.00	Wherever the workers are exposed to the hazards of falling from height, the contractor shall provide full harness safety belts fitted with fall arresting systems to all the employees working at higher elevations and life line of 8 mm diameter wire rope with turn buckles for anchoring the safety belts while working or moving at higher elevations. Safety nets shall also be provided for saving them from fall from heights and such equipment should be in accordance with BIS standards. Wherever there is a possibility of falling of any material, equipment or construction workers while working at heights, a suitable and adequate safety net should be provided. The safety net should be in accordance with BIS Standards. The contractor shall provide standard prefabricated ladders on the columns where the workers are required to use them as an access for higher elevations till permanent staircase is provided. The workers shall be provided with safety belts fitted with suitable fall arresting system (Fall arrestors) for climbing/getting down through ladders to prevent fall from height. Handling of Hazardous Chemicals The Contractor will notify well in advance to the Engineer I/c of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. NTPC shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contract shall strictly adhere to and comply with such instructions. The Engineer I/c shall have the right at his sole discretion to inspect any such container or such construction plant / equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by NTPC and NTPC shall not entertain any claim of the Contractor towards additional safety provisions / conditions to be provided for / constructed. Further, any such decision of the Engineer I/c shall not, in any way, absolve the Contractor of his responsibilities and in case, use of such a container or entry thereof into the Site area is forbidden by NTPC, the Contractor shall use alternative methods with the approval of the NTPC without any cost implication to the NTPC or extension of work schedule. Where it is necessary to provide and / or store petroleum products or petroleum mixtures and explosives, the Contractor shall be responsible for carrying-out such provision and / or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosives Act 1948, and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of the Engineer I/c. In case any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the Contractor shall be responsible for obtaining the same. The Contractor shall be fully responsible for the safe storage of his and his Sub-contractor's radio-active sources in accordance with BARC/DAE (Bhabha Atomic Research Centre/ Department of Atomic Energy, Govt. of India) Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in		
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44.08.00	connection with use, the contractor would take storage and handling of such material. The contractor shall provide suitable personal protective equipments to the workers who are handling the hazardous and corrosive substances including alkalis and acids. As a precautionary measure the contractor should keep the bottles filled with distilled water in cupboard / Boxes near work place for emergency eye wash by worker exposed to such hazardous chemicals. Eye Protection The contractor shall provide suitable personal protective equipment to his workmen depending upon the nature of hazards and ensure their usage by the workers engaged in operations like welding, cutting, chipping, grinding or similar operations which may cause injuries to his eyes.			
44.09.00	Excavation The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding material or article from any bank or side of such excavation which is more than one and a half meter above his footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.			
44.10.00	Electrical Hazards The contractor should ensure that all electrical installations at the construction work comply with the requirements of latest electricity acts / rules. The contractor shall take all adequate measures to prevent any worker from coming into physical contact with any electrical equipment or apparatus, machines or live electrical circuits which may cause electrical hazards during the construction work. The contractor shall provide the sufficient ELCBs / RCCBs for all the portable equipments, electrical switchboards, distribution panels etc. to prevent electrical shocks. The contractor should ensure use of single / double insulated hand tools or low voltage i.e., 110 volts hand tools. The contractor should also ensure that all temporary electrical installations at the construction works are provided with earth leakage circuit breakers.			
44.11.00	Vehicular Traffic The contractor should employ vehicle drivers who hold a valid driving license under the Motor Vehicles Act, 1988.			
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44.12.00 44.13.00 44.14.00 44.14.01	Lifting Appliances, Tools & Tackles, Lifting Gear And Pressure Plant & Equipment etc. The contractor shall ensure all the lifting appliances, tools & tackles including cranes etc., lifting gear including fixed or movable and any plant or gear, hoists, Pressure Plant and equipment etc. are in good condition and shall be examined by competent person and only certified shall be used at sites. Periodical Examination and the tests for all lifting / hoisting equipment & tackles shall be carried out. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by the Engineer I/c or by the person authorized by him. Excessive Noise, Vibration The contractor shall take adequate measures to protect the workers against the harmful effect of excessive noise or vibration. The noise should not exceed the limits prescribed under the concerned rules, Noise Pollution (Regulation and Control) Rules, 2000. Electrical Installations The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Employer or other contractors under any circumstances, whatsoever, unless expressly permitted in writing by the Engineer I/c to handle such fuses, wiring or electrical equipment. Before the Contractor connects any electrical appliances to any plug or socket belonging to the other contractor or the NTPC, he shall i) Satisfy the Engineer I/C that the appliance is in good working condition; ii) Inform the Engineer I/C of the maximum current rating, voltage and phases of the appliances; iii) Obtain permission of the Engineer I/C detailing the sockets to which the appliances may be connected. The Engineer I/C will not grant permission to connect until he is satisfied that: The appliance is in good condition and is fitted with suitable plug; having earth connection with the body. Wherever armored / metallic sheathed multi core cable is used, the same armored / sheathed should be connected to earth. iv) No repair work shall be carried out on any live equipment. The Engineer I/c must declare the equipment safe and a permit to work shall be issued by the NTPC / contractor as the case may be to carry out any repair / maintenance work. While working on electric lines / equipments whether live or dead,			
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	suitable type and sufficient quantity of tools will have to be provided by the contractor to electricians / workmen / Officers. v) The contractor shall employ necessary number of qualified, full time Electricians / Electrical Supervisors to maintain his temporary electrical installation. The installations are provided with suitable ELCBs and RCCBs wherever required.			
44.15.00	Safety Organisation			
44.15.01	The contractor employing more than 250 workmen whether temporary, casual, probationary, regular or permanent shall employ at least one full time safety officer exclusively to supervise safety aspects of the equipments and workmen, who will coordinate with the NTPC Safety Officer. Further requirement of safety officers, if any, shall be guided by Rule 209 of The Building and Other Construction Worker (Regulation of Employment and Conditions of Service) Central Rule 1998. In case the work is being carried out through subcontractor, the employees / workmen of the sub contractor shall also be considered as the contractor's employees/workmen for the above purpose. In case of contractor deploying less than 250 workmen he should designate one of his Engr / supervisor or the contractor himself (if he is directly supervising the work) as safety officer in addition to his existing responsibilities. The Engr./ supervisor should get atleast 2days safety training from any reputed organization or from NTPC before resuming the work. If already trained in past the declaration along with trg. certificate to be furnished to NTPC safety officer.			
44.15.02	The name and address of such Safety Officer of the Contractor will be promptly informed in writing to the EIC with a copy to the Project Safety Officer before he starts work or immediately after any change of the incumbent is made during currency of the Contract.			
44.16.00	Reporting of Accident and Investigation			
	In case any accident occurs during the construction / erection or other associated activities undertaken by the Contractor thereby causing any near miss, minor or major or fatal injury to his employees due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the Engineer I/C, NTPC Safety Officer with a copy to NTPC Head of Project in the prescribed form and also to all the authorities envisaged under the applicable laws.			
44.17.00	Right to stop Work			
44.17.01	The Engineer I/C shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipments. In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury / accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary appeal against			
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44.17.02 44.18.00 44.19.00	the order of stoppage of work to the Project Manager within 3 days of such stoppage of work and decision of the Project Manager in this respect shall be conclusive and binding on the Contractor. The Contractor shall not be entitled for any damages / compensation for stoppage of work, {Sub-Clause XVIII (I)} due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages. Fire Protection The contractor shall provide sufficient fire extinguishers at place /s of work. The fire extinguishers shall be properly maintained as per relevant BIS Standards. The employees shall be trained to operate the fire extinguishers / equipment. Penalties I If the Contractor fails in providing safe working environment as per the Safety Rules of NTPC or continues the work even after being instructed to stop the work by the Engineer I/C as provided in Clause XVIII (1) above, the Contractor shall be penalized at the rate of Rs. 25,000/- per day or part thereof till the instructions are complied with and so certified by the Engineer I/C. However, in case of accident, the provisions contained in Sub-Clause XX (II) below shall also apply in addition to the penalties mentioned in this sub-clause. II If the Contractor does not take all safety precautions and / or fails to comply with the Safety Rules as prescribed by the Employer or under the applicable law for the safety of the plant and equipment and for the safety of personnel and the contractor does not prevent hazardous conditions which cause injury to this own employees or employees of other contractors, or NTPC's employees or any other person who are at the Site or adjacent thereto, the Contractor shall be responsible for payment of penalty to NTPC as per the following schedule:- a) Fatal injury or accident causing death: Penalty @10% of contract value or Rs. 5,00,000/- per person, which ever is less. b) Major injuries or accident causing 25% or more permanent disablement to workmen or employees: Penalty @2.5% of contract value or Rs. 1,00,000/- per person which ever is less Permanent disablement shall have the same meaning as indicated in The Workmen's Compensation Act' 1923. The penalty mentioned above shall be in addition to the compensation payable to the workmen / employees under the relevant provisions of the Workmen's Compensation Act' 1923 and rules framed there under or any other applicable laws as applicable from time to time.			
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	III If any contractor worker found working without using the safety equipment like safety helmet, safety shoes, safety belts, etc. or without anchoring the safety belts while working at height the Engineer I/c / Safety Officer of NTPC shall have the right to penalize the contractor for Rs. 200/- per person per day and such worker shall be sent out of the workplace immediately and shall not be allowed to work on that day. Engineer I/c / Safety Officer of NTPC will also issue a notice in this regard to the contractor. IV If two or more fatal accidents occur at same NTPC site under the control of contractor during the period of contract and he has (1) not complied with keeping adequate PPEs in stock or (2) defaulted in providing PPEs to his workmen (3) not followed statutory requirements / NTPC safety rules (4) been issued warning notice/s by NTPC head of the project on non observance of safety norms (5) not provided safety training to all his workmen, the contractor can be debarred from getting tender documents in NTPC for two years from the date of last accident. The safety performance will also be one of the overriding criteria for evaluation of overall performance of the contractors by NTPC. The contractor shall submit the accident data including fatal / non-fatal accidents for the last 3 years where he has undertaken the construction activities Projects-wise along with the tender documents. This will also be considered for evolution of tender documents. If the information given by the contractor found incorrect, his contract will be liable to be terminated. 44.20.00 The Contractor will make available minimum quantity of all safety equipments and safety personal protection equipments (PPEs) of required specifications as per suggestive list included bidding documents as a part of "List of minimum T & P". Further Contractor will ensure availability of additional requirement for individual worker and safety equipment as per site requirement during execution of the contract till its completion. 44.21.00 Award If the Contractor's performance on safety front is found satisfactory i.e. without any fatal/reportable accident in the year of consideration; he may be considered for suitable award "ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme of the employer. 44.22.00 The Contractor shall abide by the following during Construction and Erection activities: I. Chain pulley block shall not be used for loads more than 2 (Two) tonne.			
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	II. Hydra shall not be used for material transport. III. Cage shall necessarily be provided to Monkey ladders of height more than 4 m. IV. Fencing shall be provided to all Electrical Distribution boards and transformers etc. 45.00.00 FOREIGN PERSONNEL 45.01.00 The Contractor shall submit to the Employer data on all personnel he proposes to bring into India from abroad for the performance of the Works under the Contract, at least sixty (60) days prior to their departure to India. Such data will include for each person the name, his present address, his assignment and responsibility in connection with the works, and a short resume of his qualification, experience etc. in relation to the work to be performed by him. 45.02.00 Any person unsuitable and unacceptable to the Employer shall not be brought to India. Any person brought to India, if found unsuitable or unacceptable by the Employer, the Contractor shall within a reasonable time make alternate arrangements for providing a suitable replacement and repatriation of such unsuitable personnel. 45.03.00 No person brought to India for the purposes of the works shall be repatriated without the consent of the Employer in writing, based on a written request from the Contractor for such repatriation giving reasons for such an action to the Employer. The Employer may give permission for such repatriation provided he is satisfied that the progress of work will not suffer due to such repatriation. 45.04.00 The cost of passports, visas and all other travel expenses to and from India, incurred by the Contractor shall be to his account. The Employer will not provide any residential accommodation and/or furniture for any of the Contractor's personnel including foreign personnel and Contractor shall make his own arrangements for such facilities in the area allotted at Site, to him by the Employer for that purpose. 45.05.00 The Contractor and his expatriate personnel shall respect all Indian Acts, Laws, rules and regulations and shall not in any way interfere with Indian political and religious affairs and shall conform to any other rules and regulations which the Government of India and the Employer may establish from time to time, on them. The Contractor's expatriate personnel shall work and live in close co-operation and coordination with their co-workers and the community and shall not engage themselves in any other employment neither part-time nor full-time nor shall they take part in any local politics. 45.06.00 The Employer shall assist the Contractor, to the extent possible, in obtaining necessary permits to travel to India and back, by issue of necessary certificates and other information needed by the Government agencies.			
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46.00.00 46.01.00 46.02.00 46.03.00 46.04.00 46.05.00 46.05.01 46.05.02	FOUNDATION DRESSING & GROUTING FOR EQUIPMENT/ EQUIPMENT BASES The surfaces of foundations shall be dressed to bring the top surface of the foundations to the required level, prior to placement of equipment/equipment bases on the foundations. All the equipment/ equipment bases, shall be grouted and finished by bidder as per these specifications unless otherwise recommended by the equipment manufacturer. The concrete foundation surfaces shall be properly prepared by bidder by chipping, grinding as required to bring the top of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength. Grout The grout for equipment foundation shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm² at 28 days. The grout shall be ready mix non-shrink, chloride - free, cement based, free flowing, non-metallic grout as recommended by equipment manufacturer. The ready mix grout shall be of reputed make as approved by the Employer. The Grout shall have good flowability even at very low water/ grout powder ratio. The Grout shall have characteristics of controlled expansion to be able to occupy its original volume to fill the voids and to compensate for shrinkage. Grout shall be of pre-mix variety so that only water needs to be added before use. The mixing of the Grout shall conform to the recommendations of the manufacturer of the Grout. Placing of Grout After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout, a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back & forth to push the grout into every part of the space under the base. The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.			
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46.05.03	In addition to the above, recommendations of Grout manufacturer shall also be followed.			
46.06.00	Finishing of the Edges of the Grout The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothed with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.			
46.07.00	Checking of Equipment After Grouting After the grout is set and cured, the Contractor shall check and verify the alignment of equipments, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings, etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during such post grouting check- up and verifications. Such pre and post grout records of alignment details shall be maintained by the Contractor in a manner acceptable to the Employer.			
47.00.00	SHAFT ALIGNMENTS All the shafts of rotating equipment shall be properly aligned to those of the matching equipments to as perfect an accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. The vibration level of rotating equipments measured at bearing housing shall conform to Zone A of ISO 10816. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.			
48.00.00	DOWELLING All the motors and other equipment shall be suitably doweled after alignment of shafts with tapered machined dowels as per the direction of the Employer.			
49.00.00	CHECK OUT OF CONTROL SYSTEMS After completion of wiring, cabling furnished under separate specification and laid and terminated by the Employer, the Contractor shall check out the operation of all control systems for the equipment furnished and installed under these specifications and documents.			
50.00.00	COMMISSIONING SPARES			
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50.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.			
50.02.00	These spare will be received and stored by the Contractor atleast 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilised as and when required. The unutilised spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.			
51.00.00	CABLING			
51.01.00	All cables shall be supported by conduits or cable tray run in air or in cable channels. These shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turn made of symmetrical bends or fittings. When cables are run on cable trays, they shall be clamped at a minimum intervals of 2000mm or otherwise as directed by the Employer.			
51.02.00	Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the Contractor), at every 5 meter run or part thereof and at both ends of the cable adjacent to the terminations. Cable routing is to be done in such a way that cables are accessible for any maintenance and for easy identification.			
51.03.00	Sharp bending and kinking of cables shall be avoided. The minimum radii for PVC insulated cables 1100 V grade shall be 15 D where D is the overall diameter of the cable. Installation of other cables like high voltage, coaxial, screened, compensating, mineral insulated shall be in accordance with the cable manufacturer's recommendations. Wherever cables cross roads and water, oil, sewage or gaslines, special care should be taken for the protection of the cables in designing the cable channels.			
51.04.00	In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop fault at a later date.			
51.05.00	Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to the Employer's approval. Multicore control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, as far as possible, to the point of the first conductor branch. The insulated conductors from which the jacket is removed shall be neatly twined in bundles and terminated. The bundles shall be firmly but not tightly tied utilising plastic or nylon ties or specifically treated fungus protected cord made for this purpose. Control cable conductor insulation shall be securely and evenly cut.			
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51.06.00	The connectors for control cables shall be covered with a transparent insulating sleeve so as to prevent accidental contact with ground or adjacent terminals and shall preferably terminate in Elmex terminals and washers. The insulating sleeve shall be fire resistant and shall be long enough to over pass the conductor insulation. All control cables shall be fanned out and connection made to terminal blocks and test equipment for proper operation before cables are corded together.			
52.00.00	EQUIPMENT DELIVERY AND ERECTION			
52.01.00	General Requirements			
	(a.) This part covers Contractor's responsibilities for packing, shipping, warehousing and the installation of all equipment and materials furnished and installed under this specification.			
	(b.) The Contractor shall submit for Employer's approval draft manual for Equipment Delivery and Erection (EDE Manual) covering detailed instructions, write up, technical data, drawings, check-lists, documentation formats for all activities after equipment manufacture upto installation of equipment. This manual shall cover general instructions for all equipment and specific instructions for individual equipment wherever required and shall include at least the following :			
	(1.) Instructions for packing, shipping, receiving handling, warehousing and storage.			
	(2.) Instructions for location and installation of equipment furnished by this specification.			
	(3.) Installation drawings for field mounted equipment, panels, cubicles and other equipment covered under this specification.			
	(4.) Instruction relating installation of piping/ tubing, support and routing drawings of impulse pipes/signal tubes and tube/cable trays.			
	(5.) Check lists and quality assurance hold points.			
	(6.) Format for all related documentation.			
	(c.) The EDE Manual shall conform to the requirements of this specification, all applicable codes and standards, recommendations of equipment manufacturers and accepted good engineering practices and shall be subject to Employer approval during detailed engineering.			
	(d.) The Contractor shall ensure that all work under this part shall be performed as per the requirements of this specification, Employer approved EDE Manual and drawing/documents approved by the Employer during detailed engg.			
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52.02.00	Crating (a.) All equipment and materials shall be suitably coated, wrapped, or covered and boxed or crated for moist humid tropical shipment and to prevent damage or deterioration during handling and storage at the site. (b.) Equipment shall be packed with suitable desiccants, sealed in water proof vapour-proof wrapping and packed in lumber of plywood enclosures, suitably braced, tied and skidded. Lumber enclosures shall be solid, not slatted. (c.) Desiccants shall be either silica gel or calcium sulphate, sufficiently ground to provide the required surface area and activated prior to placing in the packaging. Calcium sulphate desiccants shall be of a chemical nature to absorb moisture. In any case, the desiccant shall not be of a type that will absorb enough moisture to go into solution. Desiccants shall be packed in porous containers, strong enough to withstand handling encountered during normal shipment. Enough desiccant shall be used for the volumes enclosed in wrapping. (d.) Review by the Employer of the Contractor's proposed packaging methods shall not relieve the Contractor of responsibility for damage or deterioration to the equipment and materials specified. (e.) All accessory items shall be shipped with the equipment. ; Boxes and crates containing accessory items shall be marked so that they are identified with the main equipment. The contents of each box and crates shall be indicated by markings on the exterior. (f.) All boxes, crates, cases bundles, loose pieces, etc. shall be marked consecutively from No.1 upward throughout all shipments from a given port to completion of the order without repeating the same number. (g.) An itemized list of contents shall be enclosed inside each case and one other copy securely fastened to the outside of the case in a tin or light weight sheet metal envelope or pocket. The lists shall be plainly marked and placed in accessible locations to facilitate receipt and inspection. The packing list shall indicate whether shipment is partial or complete and shall incorporate the following information on each container, etc., according to its individual shipping number: a) Export case markings b) Case number c) Gross weight and net weight in Kilograms d) Dimensions in centimeters e) Complete description of material			
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52.03.00	(h.) Packaging or shipping units shall be designed within the limitations of unloading facilities and the equipment which will be used for transport. Complications involved with ocean shipment and the limitations of ports, railways and roads shall be considered. It shall be the Contractor's responsibility to investigate these limitations and to provide suitable packaging to permit safe handling during transit and at the job site. (i.) Electrical equipment, control and instrumentation shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, motor pump shafts, bearing and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. (j.) Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures. (k.) Coated surfaces shall be protected against impact, abrasion, discolouration and other damage. Surfaces which are damaged shall be repaired. (l.) All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be closed with forged steel plugs. All pipings, tubing, and conduit equipment and other equipment openings shall be sealed with metallic or other rough usage covers and tapped to seal the interior of the equipment piping, tubing, or conduit. (m.) Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the plant site. (n.) Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense. (o.) While packaging the material, care shall be taken for the limitation from the point of view of availability of railway wagon sizes in India.			
	Factory Assembly (a.) Instrument enclosures shall be supplied and erected completely in the factory with instrument, air supply and blow down piping with necessary valves, fittings, etc. and also all electrical wiring between the instruments and the enclosure terminal blocks. Control panel and cubicles shall also be fully wired in the factory. Control panel mounted equipments are to be dismantled from the panels before shipment and individually packed for shipment. Electronic control modules of the plug-in type are to be removed from equipment racks after factory checkout are individually packed for shipment. Other equipment shall be fully assembled at the factory, except for necessary shipping splits in panels.			
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52.04.00	(b.) All separately packaged accessories items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip, indicating what is in that carton only, shall be attached to the outside and inside of each container used for packing. A master packing slip covering all accessories items for a given piece of equipment which are shipped in separate containers, shall be attached to one container. Equipment Installation (a.) General Requirements (1.) The Contractor shall furnish all construction materials, tools and equipment and shall perform all work required for complete installation of all control and instrument equipment furnished under this specification. (2.) Contractor shall prepare detailed installation drawings for each equipment furnished under this specification for Employer's approval. Installation of all equipment/systems furnished by this specification shall be as per Employer's approval. (3.) Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. The procedures shall be acceptable to the Employer. (4.) The Contractor shall coordinate his work with other suppliers where their instruments and devices are to be installed under specifications. (b.) Installation Materials All materials required for installation, testing and commissioning of the equipment shall be furnished by the Contractor. (c.) Regulatory Requirements All installation procedures shall confirm with the accepted good engineering practice and with all applicable governmental laws, regulations and codes. (d.) Cleaning All equipment shall be cleaned of all sand, dirt and other foreign materials immediately after removal from storage and before the equipment is brought inside the power plant building or to other installation sites. All piping and tubes shall be air blown. (e.) Equipment Assembly			
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	Equipment installed under these specifications shall be assembled if shipped unassembled. The equipment shall be dismantled and reassembled as required to perform the installation and commissioning work described in these specifications. (f.) Equipment Setting Field mounted instruments and accessories shall be bracket or sub panel mounted on the nearest suitable firm steel work or masonry. The brackets, stands, supports and other miscellaneous hardware required for mounting instruments and accessories such as receiver gauge, air set, valve manifold, purge-meter etc. shall be furnished and installed. No field mounted instruments shall be installed such that it depends for support or rigidity on the impulse piping or on electrical connection to it. Indicating type field mounted instruments shall be installed in such a way that centre of indicating dial shall be about 1600-1800mm from operating floor level. Non-indicating type field instruments shall be installed such that operating handle of manifold block / isolating cock comes within 1600 mm from operating floor level. (g.) Free-Standing Equipment Free-standing Cabinets shall be attached to the floor, concrete equipment bases or supporting steel as indicated on the manufacturer's drawings and the Employer's Plant Arrangement Drawings. The cabinets shall be shimmed for proper alignment before bolting them to the floor. Adjacent enclosures shall be shimmed to maintain mutually level appearance before they are attached to floor. Vibration dampening mounts shall be installed between supporting structures and panels when specified. (h.) Non-free Standing Equipment (1.) Non-free standing local enclosures and cabinets shall be mounted in accessible locations on columns, walls, or stands in locations as indicated on the Employer's Plant Arrangement Drawings. Bracket and stands shall be fabricated as required to install the local enclosures and cabinets in a workman like manner. (2.) Rough edges and welds on all fabricated supports shall be ground smooth. The supports shall be finished with two coats of primer and two coats of paint as specified in this part. (i.) Equipment Location (1.) All individual items of equipment not located in cabinets or on panels and racks are located approximately according to the floor elevation and the nearest building column designated by the Employer.			
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	(2.) Solenoid valves not located in enclosures or mounted on valves shall be mounted in easily accessible protected locations near the components with which they are associated. (3.) All brackets, stands, supports and other miscellaneous hardware required for mounting devices shall be furnished and installed. (4.) Thermometers shall be installed in the process lines and ducts as required and adjusted for ease in reading. (5.) Permanent temperature wells on the main steam, hot reheat and cold reheat piping shall not be installed until steam blowing has been completed. Temporary temperature wells shall be installed in the main and reheat steam piping during steam blow and discarded after completion. (6.) Any required adapting hardware such as pipe bushings, nipples, drilled caps and the like shall be provided for complete installation of control devices into process connections. For location of C&I related equipment/devices, the requirement specified elsewhere in the technical specification may be referred. (j.) Installation of Field Mounted Instruments and Devices The Contractor shall submit installation drawings for all field mounted equipment furnished under this specification for Employer's approval. These drawings shall meet the requirements of this specification, installation drawings, applicable codes and standards and recommendations of manufacturers of instruments/devices. All installation work under this specification shall be strictly as per installation drawings approved by the Employer during detailed engineering stage. In addition to above relevant Portion as specified elsewhere in technical specification may be referred. (k.) Piping Connections (1.) All equipment having piping connections shall be levelled, aligned and wedged in place but shall not be grouted or bolted prior to the initial fitting and alignment of connecting piping. All equipment shall, however, be grouted or bolted to its foundation prior to final bolting or welding of the connection piping. (2.) All flanged joints shall be checked and retightened after approximately 10 days of operation at normal operating temperature. (l.) Equipment Checkout (1.) All equipment shall be cleaned after installation. Equipment subject to pressure differentials shall be checked for leakage.			
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53.00.00	(2.) After erection, all equipment having moving parts, having electrical apparatus, or subject to pressure differentials shall be trial-operated. (m.) Defects (1.) All defects in erection shall be corrected to the satisfaction of the Employer and the Project Manager. The dismantling and reassembly of Contractor furnished equipment to remove defective parts, replace parts, or make adjustments shall be included as a part of the work under these specifications. (2.) The removal of control and instrument equipment in order to allow bench calibration, if required, and the re-installation of the said equipment after calibration shall also be included as a part of the work under these specifications. (n.) Equipment Protection (1.) All equipment to be erected under these specifications shall be protected from damage of any kind from the time of contract award until commissioning of each unit. (2.) The equipment shall be protected during storage as described herein. (3.) Equipment shall be protected from weld spatter during construction. (4.) Suitable guards shall be provided for protection of personnel on all exposed rotating or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy removal and maintenance. (5.) Equipment having glass components such as gauges, or equipment having other easily breakable components, shall be protected during the construction period with plywood enclosures or other suitable means. Broken, stolen, or lost components shall be replaced by the Contractor. (6.) Machine finished surfaces, polished surfaces, or other bare metal surfaces which are not to be painted, such as machinery shafts and couplings shall be provided temporary protection during storage and constructional periods by a coating of a suitable non- drying, oily type, rust preventive compound.			
	WELDING - SPECIAL REQUIREMENTS If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed under separate specifications, the requirements shall be submitted to the Project Manager in advance of commencement of erection work.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 43 OF 53

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT			
54.00.00 DEVIATIONS DISPOSITIONING: Any deviation to the contract and employer approved documents shall be properly recorded in the format prescribed by NTPC. All the deviations shall be brought to the knowledge of employer's representative for suitable dispositioning. 55.00.00 NON-DESTRUCTIVE TESTING (NDT): The contractor shall record results of NDTs carried out at site in the format acceptable to employer. All the radiographs & its report duly signed & correlated to the job shall be handed over to the employer. Sensitivity of all the test equipment shall be compatible to the job & acceptance norms agreed. 56.00.00 TESTING EQUIPMENT & FACILITIES: Contractor shall provide the testing equipment and facilities necessary to carry out tests & inspections.				
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 44 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT			
	ANNEXURE-I <u>STANDARD CHECKLIST</u> This is an indicative list of items. The actual list shall depend on the Equipment / System being supplied by the contractor. <u>MECHANICAL</u> <u>VALVES</u> 1. Manually Operated Valve 2. Electrically Operated Valve 3. Pneumatically Actuated Valve 4. Hydraulically Actuated Valve 5. Safety Valve 6. Electromatic Relief Valve (if any) 7. Steam Trap 8. Non Return Valve (including Hydraulic/ Pneumatic QCNRVS) 9. Control Valve 10. Relief Valve 11. Differential Pressure Regulating Valve 12. Pinch valve <u>TANKS & PRESSURE VESSELS</u> 1. Limestone silos 2. Activated carbon storage silos 3. Filtrate tank 4. Waste water tank 5. Process water tank			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 45 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT	एनटीपीसी NTPC		
	6. Any other tank not covered above 7. Vacuum tanks 8. Air Receiver(if any) <u>PUMPS</u> 1. Process water pumps 2. All other slurry pumps 3. Vacuum pumps 4. Sump pumps 5. CEP, MDBFP 6. Hydraulic oil pumps 7. Lub oil pumps 8. Leachate treatment pump 9. Raw water pump 10. Effluent treatment pump <u>PIPE WORK SYSTEM</u> 1. Steam services 2. Water services 3. Slurry / Ash / chemical services 4. Air services 5. Constant load support 6. Spring supports 7. Hangers and other Supports <u>STRAINER AND FILTER</u> 1. Strainer / Filter Basket Type 2. Strainer Rotary (Low Pressure)			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 46 OF 53

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT	एनटीपीसी NTPC		
	3. Filter & Strainers Centrifugal Separators 4. Filter & Strainer Y-Type 5. Filter & Strainer (Plate Type) 6. Purifier 7. Filter – Compressed Air Line <u>FANS & COMPRESSORS</u> 1. PA / FD/ ID / burner sealing & cooling / exhaust / sealing Fans 2. Instrument / plant air / ash handling compressors <u>DAMPERS & GATES</u> 1. Manually Operated Damper 2. Pneumatically Operated Damper 3. Electrically Operated Damper 4. Manually Operated Gates 5. Pneumatically Operated Gate 6. Electrically Operated Gate <u>DUCT WORK</u> 1. Flue Gas Ducting 2. Expansion Joints 3. Observation & Access Door <u>CRANES AND ELEVATORS</u> 1. Crane 2. Hoists 3. Passenger cum goods elevator <u>POWER TRANSMISSION</u> 1. Power Transmission Gear Box			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 47 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT	एनटीपीसी NTPC		
	2. Bearings 3. Couplings <u>Grate / Boiler & AUX.SYSTEM</u> 1. Grate 2. Feed hopper 3. Pusher 4. Grate drive mechanism 5. SNCR system 6. Burner system 7. Air heaters 8. Ash handling system 9. Ash extractor 10. Drum 11. SH / water wall / economizer <u>ELELCTRICAL</u> 1. A.C Motor 2. D.C. Motor 3. VFD 4. HV Squirrel Cage Induction Motor 5. 415 V Squirrel Cage Induction Motor 6. Motor Operated Actuators 7. Soot Blower (GGH) 8. Aux. Control and Relay Panel Desk 9. SWITCHGEARS/MCC			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 48 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT	एनटीपीसी NTPC		
	(I.) STANDARD CHECLISTS FOR ALL TYPES OF RELAYS USED IN SWITCHGEARS PROTECTION SYSTEM (II.) PT CARRIAGE AND CUBICLES (III.) CABLE/BUS DUCT/BUS BARS (IV.) CONTRACTOR MODULE (V.) SWITCH FUSE MODULE (VI.) MASTER PANEL OF LUBE OIL PANEL (VII.) FEEDER PANEL OF LUBE OIL PANEL (VIII.) SPACE HEATER AND CABLE MODULE (IX.) HT CIRCUIT BREAKER (X.) 415 V CIRCUIT BREAKER POWER CABLE AUXILIARY CABLE D.C. CABLE EXPLOSION PROOF ELECTRICAL EQUIPMENT JUNCTION BOX CONTROL TRANSFORMER MODULE BRUSH GEAR ASSEMBLY AUX. CONTROL AND RELAY PANEL DESK INDICATING INSTRUMENT RECORDING INSTRUMENT INTEGRATING INSTRUMENT <u>CONTROL & INSTRUMENTATION</u> 1. Conductivity Measuring Equipment Including Test Procedures 2. pH Analyser Including Test procedure			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 49 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT	एनटीपीसी NTPC		
	3. Silica Analyser 4. Level Switch (Float Actuated) 5. Level Switch (Electrode Type) 6. Level Switch (Displacer Actuated) 7. Transmitter (Float Operated Pneumatic Output including Testing procedures) 8. Level indicator (Float/Pulley Type) 9. Local Temperature Indicator Including Test Procedure 10. Resistance Thermometer Element Including Test procedure 11. Thermocouple Element and Connecting Cable 12. Thermocouple and Resistance Thermometer Convertor/Transmitter Including Test Procedures 13. Temperature Switch Including Test Procedure 14. Cold Junction Boxes 15. O₂Analyser 16. SO₂ / NO_x / HF / CO / TOC / Hg/ heavy metal /Cd+ti / H₂Oanalyzer 17. O₂ in Hydrogen including Test procedures 18. Pressure and Vacuum Gauge 19. Pressure and Vacuum Switch Including Test procedures 20. Differential Pressure Transmitter including Test Procedures 21. Differential pressure switch including Test procedures 22. Flow indicator (Variable Area) 23. Orifice plate 24. Flow Switch 25. Nozzle 26. Flow Integrator (pneumatic input) including test procedure			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 50 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT	एनटीपीसी NTPC		
	27. Flow indicator (Float Operated) Including Test Procedure 28. Venturi (Fluid) 29. Flow Switch (Magnetic Type) 30. Limit Switches 31. Turbine Supervisory Measuring System 32. Position Measurement & Indication Including Test procedures 33. Vibration Measurement 34. Digital Indicator 35. Moving Coil Indicator Including Test Procedures 36. Recorder Including Test procedure 37. Flame Scanner 38. Electrical Auto Manual Control Station 39. Push Button Module 40. Test Procedure for Electronic Modules of DDCMIS 41. Alarm Annunciator Equipment Including Test Procedure 42. Test procedure for Adjustment of Modulating Controller-PID Term 43. Test Procedure Indicating Controller-Electrical Input & Pneumatic Output 44. Density monitors Note: The items which are not part of this specification may be considered as not applicable.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 51 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT			
	ANNEXURE-II BRIEF WRITE UP ON THE CONTENTS OF TESTING SCHEDULE / COMMISSIONING SCHEDULE Testing Schedules should be designed to ensure that the plant area, equipment or apparatus are tested and commissioned and will operate as per the employer's specifications and good engineering practices. Testing Schedule/Commissioning Schedule is required to be of a standard format in order to maintain consistency of presentation, content and reporting. Testing Schedule/Commissioning Schedule should contain the following sections to make the document a self contained one: 1. Plant Details/Design data 2. Testing Objective/Proposals 3. State of the Plant a) Erection Status with respect to Mech. Elect and C&I b) Availability of the services required c) Safety requirements as per Manufacturer's 4. Test method including completion/acceptance criteria 5. Results 6. Appendix a) Testing Programme b) Mech/Elect/C&I -Plant item completing list c) List of Drawing/documents required for carrying out the testing.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 52 OF 53	

CLAUSE NO.	ERECTION CONDITIONS OF CONTRACT		
	ANNEXURE - III SAFETY PLAN 01. Safety Policy of the Contractor to be enclosed: 02. When was the Safety Policy last reviewed: 03. Details of implementation procedure / methods to implement Safety Policy / Safety Rules: 04. Name, Qualification, experience of Safety Officer 05. Review of Accidents Analysis Method, Methods to ensure Safety and Health: 06. Unit executive responsible to ensure Safety at various levels in work area: 07. List of employees trained in safety employed before execution of the job. Give the details of training: 08. Safety Training Targets, Schedules, methods Adopting to providing safety training to all employees: 09. Details of checklist for different jobs / work and responsible person to ensure compliance (copy of checklist to be enclosed): 10. Regular Safety Inspection Methods and Periodicity and list of members to be enclosed: 11. Risk Assessment, Safety Audit by Professional Agencies, Periodicity: 12. Implementation of Recommendations of Audit / Inspections. Procedures for implementation and follow up: 13. Provision for treatment of injured persons at work site: 14. Review of overall safety by top Management and Periodicity: 15. System for Implementation of Statutory legislations: 16. Issue of PPEs to employees, Periodicity / stock on hand etc: Signature Head of the Organisation with date & stamp		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-D BID DOC. NO.: CS-2600-001-9	ERECTION CONDITIONS OF CONTRACT	PAGE 53 OF 53

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
WASTE TO ENERGY PROJECT AT KAWAS, SURAT**

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – E

(TENDER DRAWINGS)

SECTION - VI

BID DOC. NO.: CS-2600-001-9

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 400 TPD
MUNICIPAL SOLID WASTE TO ENERGY PROJECT**

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – E

(TENDER DRAWINGS)

SECTION - VI

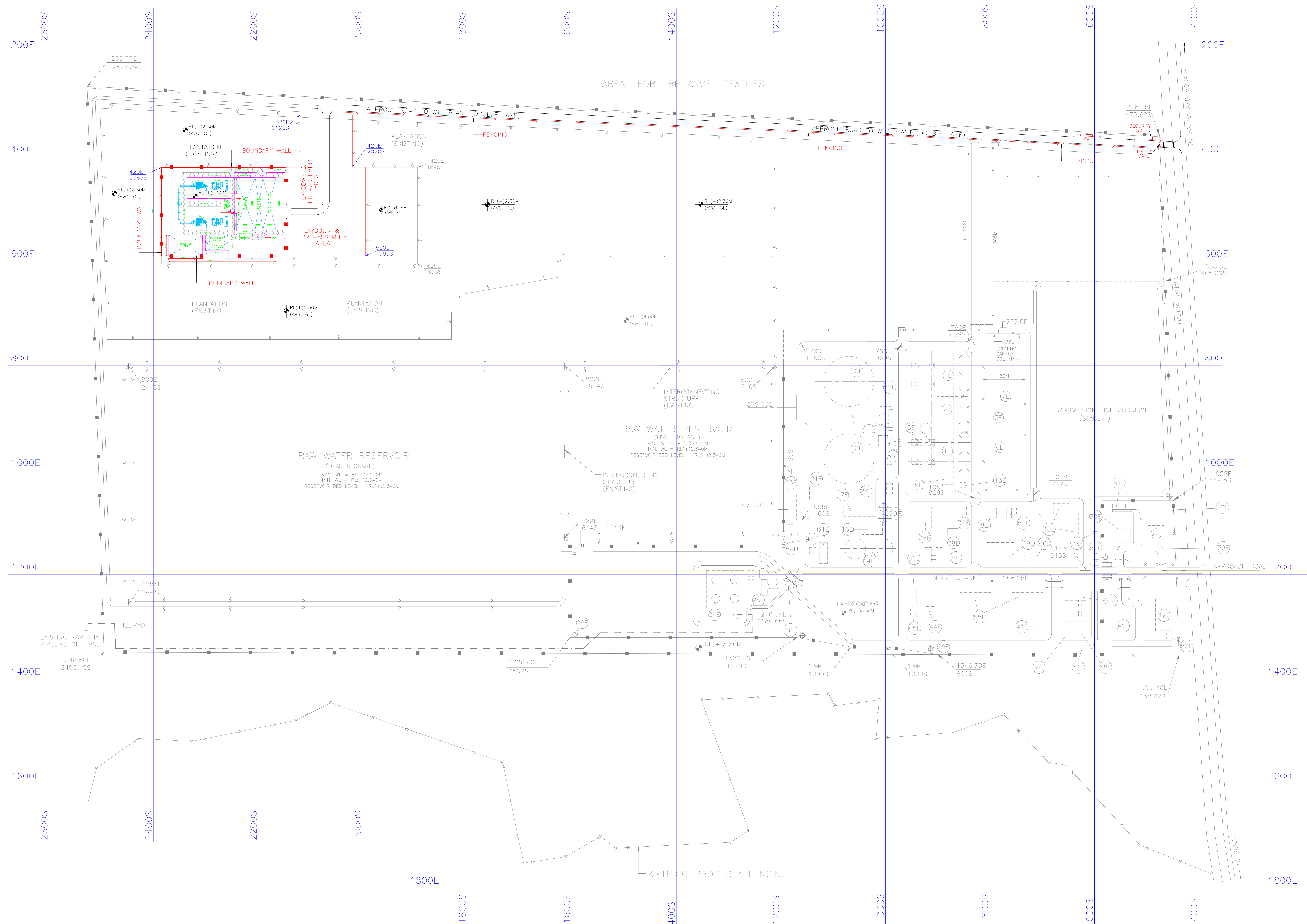
BID DOC. NO.: CS-2600-001-9

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PART – E

TENDER DRAWINGS

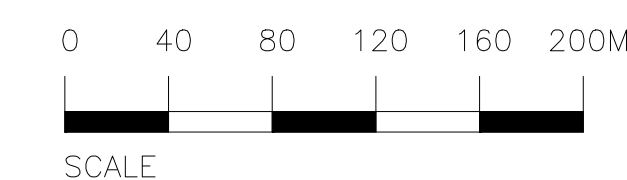
CLAUSE NO.	LIST OF TENDER DRAWINGS			एनटीपीसी NTPC
APPLICABLE DRAWINGS FOR THE PACKAGE The drawings listed below and forming part of the specification shall be supplement to the requirements specified herein. The scope and terminal points of the equipment to be furnished under this package shall be as identified in these drawings and read in conjunction with the text of the specification.				
Sl. No.	Drawing Title	Drawing No.	Rev. No.	
1.	General Layout plan	2600-001-POC-A-001	0	
2.	Distributed digital control, monitoring And information system (DDCMIS) configuration diagram	2600-001-9-POI-A-001	0	
3.	Electrical Single line Diagram for Waste to Energy Plant	2600-001-9-POE-A-001	0	
Note: All the above drawings indicates Employer’s requirements to enable the bidder to make a suitable offer. All variations / alternations shall be clearly brought out in the technical deviation scheduled with implications, if any. Such variations may be acceptable, after assessment of it’s implication and shall be subjected to the Employer’s approval.				
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-E BID DOC. NO.: CS-2600-001-9	LIST OF TENDER DRAWINGS	PAGE 1 OF 1



- NOTES:-**
- FORMATION LEVEL SHALL BE RL(+5.50M UNLESS OTHERWISE NOTED.
 - EL(+0.00M CORRESPONDS TO RL(+6.00M.
 - LAYOUT OF VARIOUS FACILITIES FOR WTE PLANT AS SHOWN IN THE LAYOUT BLOCK IS INDICATIVE ONLY. THE FINAL ARRANGEMENT WILL DEPEND ON THE PLANT LAYOUT AS DEVELOPED BY THE BIDDER SUBJECT TO APPROVAL BY THE OWNER.
 - THE MAIN PLANT LAYOUT INDICATED IN THIS DRG IS FOR 2X350 TPD MODULE. FOR ALTERNATIVE PROPOSAL BIDDER SHALL HAVE TO DEVELOP LAYOUT WITHIN THE SPACE AVAILABLE AS SHOWN ABOVE.
 - THE AREA FOR CONSTRUCTION/ERECTION ACTIVITIES LIKE LAYDOWN, PREASSEMBLY, OFFICES & STORES IS TO BE MANAGED BY THE BIDDER WITHIN THE AREAS IDENTIFIED FOR WTE PLANT. THE FINAL LOCATION AND EXTENT OF AREA SHALL BE AS DIRECTED BY THE ENGINEER.
 - BIDDER SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES DURING EXECUTION OF WTE PLANT AND SHALL MAKE ALL NECESSARY ARRANGEMENTS FOR PROTECTING THE SAME. DETAILS OF EXISTING FACILITIES ARE AVAILABLE WITH THE OWNER AND SAME CAN BE REFERRED BY BIDDER IF FELT NECESSARY.

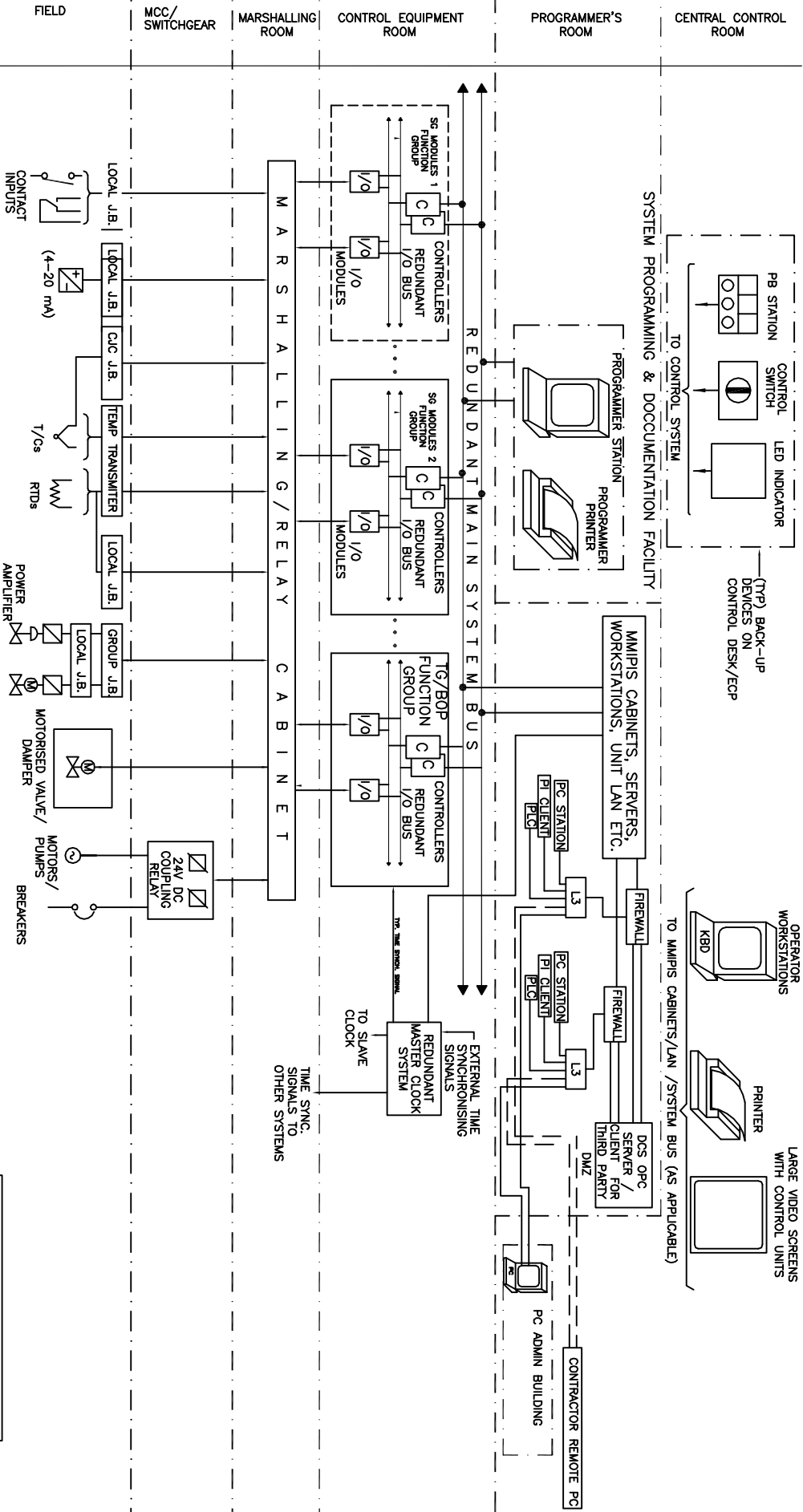
- LEGEND:-**
- ROADS (i) SINGLE LANE (ii) DOUBLE LANE
 - EMBANKMENT
 - BOUNDARY WALL
 - FENCING
 - WATCH TOWERS
 - EXISTING BOUNDARY WALL (3.0M HIGH)
 - FORMATION LEVEL

FOR TENDER PURPOSE ONLY



PROJECT		KAWAS WASTE TO ENERGY PLANT	
TITLE		GENERAL LAYOUT PLAN	
SIZE	SCALE	DRG. NO.	REV. NO.
A1	1:4000	2600-001-POC-A-001	A

MANOJ	RV	RV	-	-	-	-	RB	02.04.19
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	ES
CLEARED BY				APPD	DATE			



NOTES:-
1. THIS SKETCH IS INDICATIVE . TO EXPLAIN CONFIGURATION. PLEASE REFER PART-A & B OF TECHNICAL SPECIFICATION FOR DETAILS.

एन टी पी सी
NTPC
नेशनल थर्मल पावर कॉर्पोरेशन लिमिटेड
National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

[FOR TENDER PURPOSE ONLY]

PROJECT

TYPICAL WASTE TO ENERGY PLANT

TITLE
DISTRIBUTED DIGITAL CONTROL, MONITORING
AND INFORMATION SYSTEM (DDCMS)
CONFIGURATION DIAGRAM

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE										22.06.17		N.T.S.	2600-999-POI-A-001	A
C L E A R E D B Y															

GENERAL NOTES:

1. THE SELECTION OF LT OUTGOING FEEDERS(DRAW OUT TYPE) SHALL BE AS INDICATED HEREUNDER:

- upto 400 A – MCCB
- ABOVE 400 A – BREAKER

2. CONTROL AND PROTECTION SUPPLIES FOR ALL SWITCHGEARS/ DBS/CONTROL PANELS SHALL BE FED FROM TWO DIFFERENT SOURCES/DIFFERENT SECTIONS.

3. STANDARD LT TRANSFORMER RATINGS WITH THEIR IMPEDANCES ARE AS FOLLOWS

SL NO.	TRF RATING	% IMPEDANCE (Reference as per IS)
1.	2.5 MVA	12.5 %
2.	2.0 MVA	10 %
3.	1.6 MVA	8 %
4.	1.0 MVA	5 %
5.	0.63 MVA	5 %

4. WHEREVER MINIMUM RATING OR NO RATING HAS BEEN INDICATED, SIZING SHALL BE CARRIED OUT AS PER SYSTEM REQUIREMENT AND FINAL DRIVE LIST. FINAL FEEDING ARRANGEMENT TO BE DECIDED DURING DETAILED ENGINEERING AS PER SIZING CRITERIA SPECIFIED IN THE TECHNICAL SPECIFICATION HOWEVER EQUIPMENT SUPPLIED SHALL BE OF ATLEAST MINIMUM SPECIFIED RATING

5. 3x50% FEEDING ARRANGEMENT MAY BE USED FOR 415 VOLTS LOAD CENTERS WHERE THE TOTAL LT LOAD IS MORE THAN 2.15 MVA.

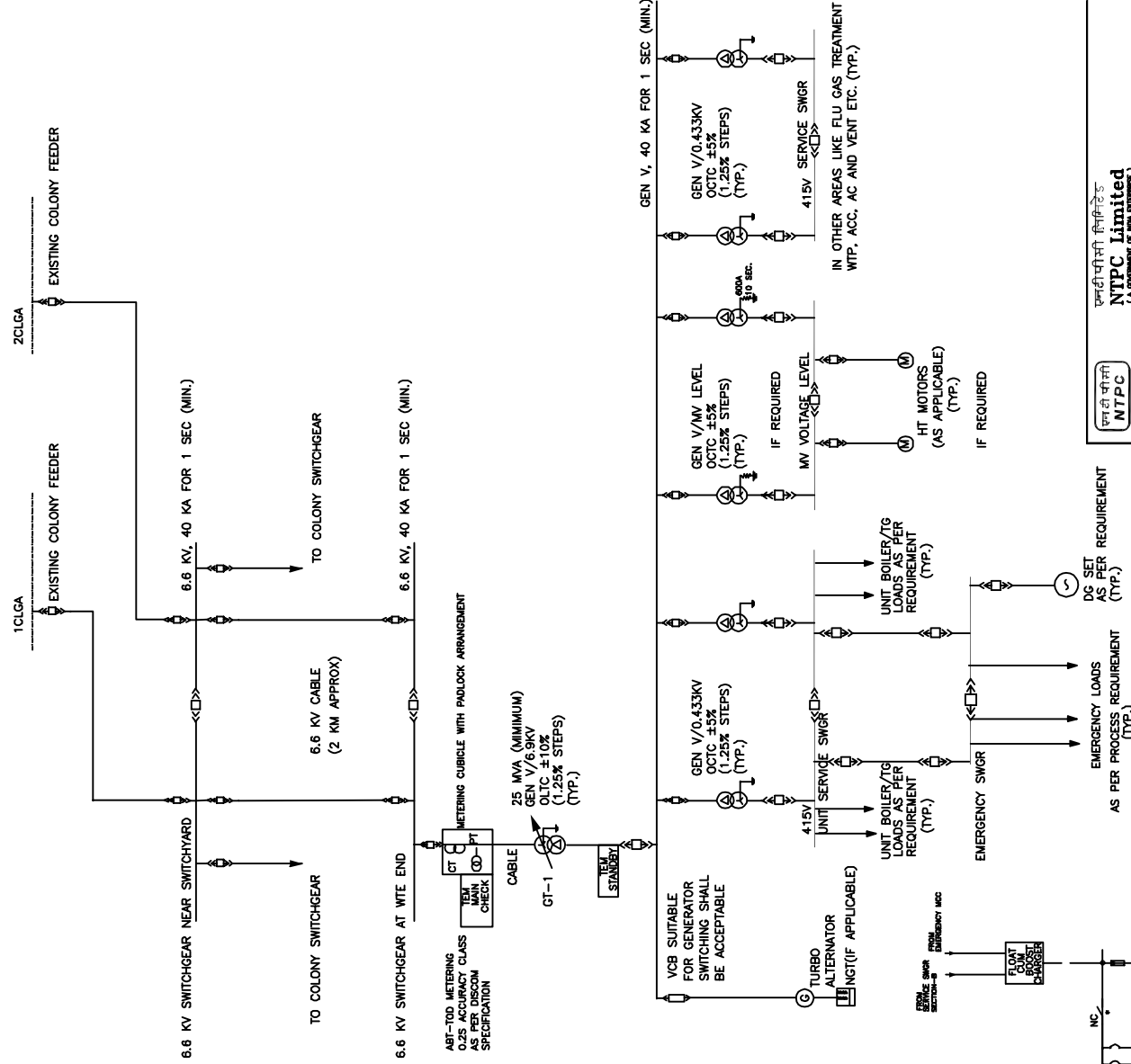
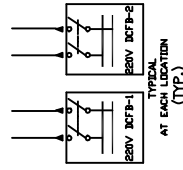
6. NUMBER OF MOTORS/FEEDERS SHOWN IN THE SLD IS TYPICAL AND FEEDING ARRANGEMENT SHOWN AT VARIOUS LOAD CENTERS IS INDICATIVE IN NATURE SHOWING THE FUNCTIONAL REQUIREMENTS.

7. BIDDER SHALL PROVIDE DC SYSTEM OF ADEQUATE CAPACITY FOR MEETING DC LOADS FOR THE PLANT.

8. MINIMUM ONE NUMBER DG SET COMMON FOR ENTIRE WTE PLANT SHALL BE PROVIDED BY THE BIDDER FOR MEETING THE EMERGENCY PROCESS LOADS ENVISAGED FOR WTE PLANT.

9. ALL BATTERY CHARGERS SHALL HAVE 2 INPUT SUPPLIES ALONG WITH SUITABLE AUTOMATIC CHANGEOVER BETWEEN THE SOURCES.

10. LOCATION OF TARIFF ENERGY METERS SHOWN IS TENTATIVE AND MAY CHANGE AS PER THE DISCOM REGULATION.



FOR F.R PURPOSE ONLY

REV. NO.	DESCRIPTION	DATE	APPROVED	DESIGNED	CHECKED	SCALE	DRAWING NO.	PROJECT
1						NTS	2600 -999-P08-J-001	WTE PROJECT AT KAWAS

एनटीपीसी लिमिटेड
NTPC Limited
(A COMPANY OF PUBLIC SECTOR)

WTE PROJECT AT KAWAS

REV. NO.	DESCRIPTION	DATE	APPROVED	DESIGNED	CHECKED	SCALE	DRAWING NO.	PROJECT
1						NTS	2600 -999-P08-J-001	WTE PROJECT AT KAWAS

OUTGOING DC FEEDERS AS PER REQUIREMENT (TYP.)

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
WASTE TO ENERGY PROJECT AT KAWAS, SURAT**

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – F

(MANDATORY SPARES)

SECTION - VI

BID DOC. NO.: CS-2600-001-9

NTPC Limited

(A Government of India Enterprise)



**EPC PACKAGE FOR SETTING UP 700 TPD (2 X 350 TPD)
WASTE TO ENERGY PROJECT AT KAWAS, SURAT**

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – F

(MANDATORY SPARES)

SECTION - VI

BID DOC. NO.: CS-2600-001-9

(This document is meant for the exclusive purpose of bidding against this Package and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

PART-F

SPARES

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
1.00.00	Recommended Spares 1. The present scope covers supply of all necessary spares and consumables for successful operation & maintenance of entire plant for an initial period of 2 years. 2. A complete list of recommended spare & consumable needs to be submitted along with the offer. 3. Vendor needs to store the recommended / mandatory spare / consumable in a proper manner and place (which is also included in the scope of this work) and maintain proper record of the same. If required vendor shall create adequate facility to preserve the spare in a good condition. 4. During the O&M period of 2 years, whenever required the vendor shall procure the necessary spare / consumable (or from their stock), with necessary documentation for drawl of spare / consumable from the their store (entry in the store register), but the same spare / consumable needs to replenished immediately as per lead time of the supply so as to ensure availability of spare and trouble free operation of unit. 5. The vendor needs to replace the spare part, which was consumed from the store with the same / identical spare, which was supplied initially from the same supplier of same quality. 6. In addition, the vendor also needs to provide a complete list of various consumables/spares used in the plant during the 2 year O&M period. 7. The vendor shall agree to supply the spares / consumable, if required at later stage, as per the NTPC requirement, after 2 years of O&M period. 8. At the end of the 2 years of O&M contract, the vendor needs to handover full set of 2 year recommended spares, which have been supplied under this contract.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART- F id Doc. No.: CS-2600-001-9	MANDATORY SPARES	PAGE 1 OF 1	

CLAUSE NO.	BIDDER'S NAME.....							
		(c) Voltage class & current						
		(d) Number of steps						
		(e) Range						
		(f) Step voltage						
		(g) Rated Short circuit current						
		(i) Dynamic						
		(ii) Thermal						
		(h) Withstand time for Short circuit (sec.)						
		(i) Dynamic						
		(ii) Thermal						
		(i) No. of revolution to complete One step						
		(j) Insulation level of the connecting leads between tap changer & transformer winding						
		(k) Total quantity of oil						
		(l) Whether On load Type or Off load Type						
	1.22	Insulation level						
		HV Windings						
		(i) (a) Lightning impulse withstand voltage (kVp)						
		(b) CW Impulse withstand voltage (kVp)						
		(ii) Switching surge withstand voltage (kVp)						
		(iii) Power frequency withstand voltage (kV)						
<table border="1"> <tr> <td>Kawas WTE Project (2× 350 TPD) EPC Package</td> <td> TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9 </td> <td> DB:01 GENERATOR AND GENRATOR AUXILLIARIES </td> <td> PAGE 25 OF 26 </td> </tr> </table>					Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 25 OF 26
Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 25 OF 26					

CLAUSE NO.	BIDDER'S NAME.....				
		(iv) HV winding insulation (Graded/ Uniform)			
		LV Windings			
		(i) Lightning impulse withstand voltage (kVp)			
		(ii) Power frequency withstand voltage (kV)			
		HV Bushings			
		(i) (a) Lightning impulse withstand voltage(kVp)			
		(b) CW Impulse withstand voltage (kVp)			
		(ii) Switching surge withstand voltage (kVP)			
		(iii) Power frequency withstand voltage (KV)			
		LV Bushings			
		(i) Lightning impulse withstand voltage (kVp)			
		(ii) Power frequency withstand voltage (kV)			
		HVN Bushings			
		(i) Lightning impulse withstand voltage (kVp)			
		(ii) Power frequency withstand voltage (kV)			
		LVN Bushings			
		(i) Lightning impulse withstand voltage (kVp)			
		(ii) Power frequency withstand voltage (kV)			
	1.23	Approximate Dimensions			
		a) Tank (lxbxh) (mm)			
		b) Overall dimensions with coolers (lxbxh) (mm)			
	Kawas WTE Project (2x 350 TPD) EPC Package		TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9		DB:01 GENERATOR AND GENRATOR AUXILLIARIES
					PAGE 26 OF 26

CLAUSE NO.	BIDDER'S NAME.....				
		c) Height for un-tanking (mm)			
		d) Shipping dimensions			
		e) Dimensions of largest package(lxbxh) (mm)			
	1.24	Weights of Transformer Components			
		a) Core (kg.)			
		b) Windings (kg.)(copper)			
		c) Total cellulose weight (kg)			
		d) Weight of Paper insulation (kg)			
		e) Weight of Press board, frame, barrier, spacer etc (kg)			
		f) Tank and fittings (kg)			
		g) Oil (kg)			
		h) Untanking weight (heaviest piece) (kg)			
		i) Total weight (kg)			
		j) Weight of heaviest pkg. (kg)			
		k) Total shipping weight (kg)			
		l) Parts detached for transport(furnish list)			
	1.25	Permissible overloading (% of rating and time in minutes)			
	1.26	(a.)Clearances to tank in oil (mm)			
		(b.) Minimum clearance of HV winding to earth in oil (mm)			
		(c.) Clearance between coils & core(mm)			
		(d.) Clearance between coils (mm)			
	Kawas WTE Project (2× 350 TPD) EPC Package TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9 DB:01 GENERATOR AND GENRATOR AUXILLIARIES PAGE 27 OF 26				

CLAUSE NO.	BIDDER'S NAME.....						
		(e.) Clearance between neutral to ground (mm)					
	1.27	Conservator					
		a) Total volume (Liters)					
		b) Volume between highest and lowest levels (Liters)					
	1.28	Capacitance Values (pF)					
		a) LV to earth					
		b) HV to LV					
		c) Tap winding to earth					
	1.29	a) Type of oil preservation					
		b) Material of diaphragm/air cell					
		c) Continuous temperature withstand/ capability of the diaphragm/air cell					
	1.30	Oil	Before filling in main tank				
		a) Quality of oil					
		i) Moisture content (ppm)					
		ii) Max. tan-delta value					
		iii) Interfacial tension(N/m)					
		iv) Breakdown strength (kV)					
		b) Total Quantity including 5% extra (liters)					
			Before Energizing				
		i) Moisture content (ppm)					
	ii) Max. tan-delta value						
<table border="1"> <tr> <td>Kawas WTE Project (2× 350 TPD) EPC Package</td> <td>TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9</td> <td>DB:01 GENERATOR AND GENRATOR AUXILLIARIES</td> <td>PAGE 28 OF 26</td> </tr> </table>				Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 28 OF 26
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CLAUSE NO.	BIDDER'S NAME.....							
		iii) Interfacial tension(N/m)						
		iv) Breakdown strength (kV)						
		b) Total Quantity including 5% extra (liters)						
		c) Oil flow inside Transformer (Directed/ Forced/ Normal)						
	1.31	Core						
		a) Type of construction(core/shell)						
		b) Net core area (mm ²)						
		c) Core material and grade used						
		d) Type of joint between core and yoke						
		e) Thickness of stamping (mm)						
		f) Percentage silicon content (%)						
		g) Maximum flux density in core at rated frequency and at						
		i) 90% voltage (wb/m ²)						
		ii) 100% voltage (wb/m ²)						
		iii) 110% voltage (wb/m ²)						
	1.32	Winding						
		a) Type of winding						
		i) HV						
		ii) LV						
		iv) Tap						
		b) Current density at rated load						
		i) HV (A/mm ²)						
	<table border="1"> <tr> <td>Kawas WTE Project (2× 350 TPD) EPC Package</td> <td>TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9</td> <td>DB:01 GENERATOR AND GENRATOR AUXILLIARIES</td> <td>PAGE 29 OF 26</td> </tr> </table>					Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES
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CLAUSE NO.	BIDDER'S NAME.....							
		ii) LV						
		iv) Tap						
		c) Conductor area (mm ²)						
		i) HV						
		ii) MV						
		iv) Tap						
		d) Magnetizing inrush current(Amps)						
		i) % Component of 2 nd harmonic current (max & min)						
		e) No load current (Amps) at rated frequency and at						
		i) 90% voltage						
		ii) 100% voltage						
		iii) 110% voltage						
		f) Magnetising current at rated frequency and at rated voltage						
		g) Leakage reactance						
		i) HV						
		iii) LV						
		h) Resistance						
		i) HV						
		iii) LV						
		i) Air core reactance of HV winding						
	1.33	Tank						
		a) Tank cover-Conventional/Bell Type						
		b) Approximate thickness of						
		i) Side (mm)						
	<table border="1"> <tr> <td>Kawas WTE Project (2× 350 TPD) EPC Package</td> <td>TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9</td> <td>DB:01 GENERATOR AND GENRATOR AUXILLIARIES</td> <td>PAGE 30 OF 26</td> </tr> </table>				Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 30 OF 26
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CLAUSE NO.		BIDDER'S NAME.....			
1.1		ii) Bottom (mm)			
		iii) Cover			
	1.34	Vacuum withstand capability of			
		a) Main tank			
		b) Coolers and accessories			
	1.35	Minimum draw bar pull required to move the transformer on level track(kg)			
	1.36	Size of filter hose			
	1.37	Fault level			
		1.38.00	Tan delta value at 20 deg C <1%		(Yes/No)
Technical Particulars and Drawings of Cables a) Sectional drawings of cables : b) Approx. Weight of metallic and non metallic items of each cable size (Kgs) Metallic (Kgs/Km) : Non Metallic (Kgs/Km) : c) Rating factors for variation					
Kawas WTE Project (2x 350 TPD) EPC Package		TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9		DB:01 GENERATOR AND GENRATOR AUXILLIARIES	
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CLAUSE NO.	BIDDER'S NAME.....			
1.2	in ambient air temp.	:		
	d) Rating factors for vibration in amb. In ambient air temp.	:		
	e) Rating factors for variation depth of laying in ground	:		
	f) Rating factors for variation in thermal resistivity of soil	:		
	g) Grouping factors for cables laid in open air racks	:		
	h) Grouping factors for cables in build up concrete trenches with restricted air circulation	:		
	i) Grouping factors for cables laid in ground	:		
	j) Particulars of cable drums	:		
	k) Grouping factors for cables laid in ducts/pipes	:		
	Test Certificates Complete test reports including Type Tests, Routine tests and Acceptance Tests :			
Kawas WTE Project (2x 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 32 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
1.3	Instruction manual for storage for prolonged duration, unpacking, handling at site, erection, pre-commissioning test etc. :			
1.4	Technical Data			
1.4.1	The following technical data shall be submitted by the contractor for each type and size of the cable for Employer's approval. 1. Make : 2. Country of manufacturer : 3. Type designation : 4. Applicable standard : 5. Cable size (No. of Cores x mm2) : 6. Rated Voltage : 7. Continuous current rating for maximum conductor temp. when laid in air at ambient of 50 deg. C. a) When metallic screen /armour			
Kawas WTE Project (2x 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 33 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
	is earthed at one end (Amps) : b) When metallic screen/armour is earthed at both the ends (Amps) : c) For unscreened, unarmoured Cables (Amps) : 8. Continuous current rating for max. conductor temp. when buried in soil having thermal resistivity of 150 deg. C Cm/N at a depth of 1 mtr. and at ground ambient temp. of 40 deg. C. a) When metallic screen / armour is earthed at one end (Amps) : b) When metallic screen/ armour is earthed at both the ends (Amps) : c) For unscreened, unarmoured cables (Amps) : 9. Short circuit withstand capacity and duration for : a) Conductor : b) Metallic screen :			
Kawas WTE Project (2x 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 34 OF 26	

CLAUSE NO.	BIDDER'S NAME..... 			
	c) Armour : 10. Conductor a) Material (Copper or Aluminium) : b) Grade : c) Nominal cross sectional area (Sq. mm) : d) Number and diameter of wire before compacting of conductor strands i) No. of wires (min.) : ii) Dia of wires in mm : e) Shape of conductor : f) Diameter over conductor (mm) : i) Fictitious : (as per IS 10462 (Part-1)-1983) ii) Approximate :			
Kawas WTE Project (2x 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 35 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
	g) Direction of lay of stranded layers : h) Conductor resistance (DC) At 20 deg C in Ohm/Km (max.) : i) Conductor resistance (AC) a) at 20 deg. C ohm/Km (Approx) : b) at 90 deg. C in ohm/Km (Approx) (for XLPE cables) : j) Reactance per phase at 50 Hz in ohm/km : k) Capacitance at 50 hz in micro Farads / Km : l) Conductor screening (wherever applicable) a) Material and type : b) Thickness of extruded layer (mm) : 12. Insulation a) Composition of insulation : b) Nominal thickness of insulation :			
Kawas WTE Project (2x 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 36 OF 26	

CLAUSE NO.	BIDDER'S NAME..... 			
	(mm) c) Tolerance on thickness of Insulation (mm) : d) Filled or unfilled (for XLPE only) : e) Type of curing (for XLPE only) : f) Min. insulation resistance at 20 deg. C (Mega Ohm/Km) : g) Identification of cores : 13. Insulation screening (wherever applicable) : a) Material & type : b) Thickness of extruded layer (mm) : 14. Metallic Screen a) Material : b) Size of tape /wire (mm) : c) No. of wires / tapes :			
Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 37 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
	d) Short circuit capacity of metallic screen : e) Cross sectional area of screen (sq. mm) : f) Dia below metallic screen i.e. below copper tape/wire (mm) : 15. Inner sheath a) Material : b) Diameter over the laid up cores (mm) i) Calculated : (By fictitious calculations as per IS 10462 (part-1)-1983) ii) Approximate : c) Thickness of sheath (Min) (mm) : d) Colour of sheath : e) Tolerance in thickness of inner sheath (mm) : 16. Type of filler material :			
Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 38 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
	17. Armour (in case of armoured cables) a) Type of material of armour : b) Formed wire / wire : c) Diameter of cable over inner sheath (under armour) mm i) Calculated : (By Fictitious calculations as per IS 10462 (part-1)-1983) ii) Approximate : d) Dimension of formed wire / wire in mm : e) No. of armour formed wires /wires : f) Approx. cross sectional area of armour (Sq. mm) : g) Resistivity of armour wire : at 20 deg. C (ohm- cm.)			
Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 39 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
	h) Direction of lay of armour : 18. Outer Sheath a) Material and type : b) Diameter under the sheath (mm) i) Calculated : (By Fictitious calculations as per IS 10462 (part-1) - 1983) ii) Approximate : c) Thickness of sheath (mm) : d) Tolerance on Nominal thickness of sheath (mm) : e) Colour of sheath : 19. a) Overall diameter of cable (mm) : b) Tolerance on overall diameter (mm) : c) Eccentricity : d) Ovality :			
Kawas WTE Project (2× 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 40 OF 26	

CLAUSE NO.	BIDDER'S NAME.....			
	20. Weight per 1000 mtrs (Kg) : 21. Recommended min installation radius (mm) : 22. Safe pulling force when pulled by pulling eye on the conductor (kg) : 23. Cable Drums a) Type (Wooden/steel) : b) Dimensions (Approx) : i) Flange diameter (mm) : ii) Barrel diameter (mm) : iii) Traverse (mm) : c) Weight of cable drum with Cables (Kgs) : 24. Max. / standard length per drum for each size of cable (mtr.) and tolerance (%) : 25. Guaranteed value of min. oxygen index of outer sheath :			
Kawas WTE Project (2x 350 TPD) EPC Package	TECHNICAL DATA SHEETS SECTION – VI PART-G BID DOC NO : CS-2600-001-9	DB:01 GENERATOR AND GENRATOR AUXILLIARIES	PAGE 41 OF 26	

CLAUSE NO.	BIDDER'S NAME..... 			
	26. Max. acid gas generation by weight (%) : 27. Maximum smoke density rating (%) : 28. Voltage developed in the screen/armour per 100 mt run with screen / armour earthed at one end when cables is carrying (for single core cables only) a) Rated current (Volts) : b) Short circuit current (Volts) i) in the screen : ii) in the armour : 29. Circulating current developed in the screen/armour for 100 mt. run, with screen/armour earthed at both ends when cable is carrying (for single core cables only) a) Rated current(Amps) : b) Short circuit current (amps) : i) in the screen :			
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CLAUSE NO.	BIDDER'S NAME.....			
	ii) in the armour :			
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	ESSENTIAL DATA SHEETS FOR WATER SYSTEM Essential Data to be necessarily furnished with the Bid 1.00.00 Raw Water booster Pumps (if applicable) a). Type of pump : b). No of pumps : c). Capacity of pump : d). Pump Head : e). Motor input power : 2.00.00 PT Plant a). Pre-Treatment process/Type : b). PT plant capacity : 3.00.00 DM Plant a). DM Treatment process/Type : b). DM Plant Capacity : 4.00.00 Leachate Treatment plant a). Design rating : b). Steam Consumption : 5.00.00 Effluent Treatment plant a). Effluent Treatment Process : b). Design rating : 6.00.00 Condensate polishing unit a). Effluent Treatment Process : b). Design rating :			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-I SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 1 OF 1

CLAUSE NO.	BIDDER'S NAME			
	CHAPTER - II			
1.00.00	GENERAL TECHNICAL INFORMATION /DATA/DRAWINGS TO BE SUBMITTED ALONGWITH THE BID			
1.01.00	Performance Data	Reference Drg.		
	i) Boiler efficiency vs. load curves	.....		
	ii) Characteristics curves showing the variation of superheated Steam temperature with load, clearly indicating the regime of attemperation	.....		
	iii) Characteristics curves of steam generating unit showing variation in efficiency, steam temperature and pressure with loads	.....		
	iv) Correction curves for steam generator efficiency for variation in parameters such as :	.....		
	a) Load	.....		
	b) Superheater outlet temperature	.....		
	c) Superheater outlet pressure	.....		
	d) Feed water inlet temp.	.....		
	e) Excess air (at economiser outlet)	.....		
	f) Humidity	.....		
	g) Variation in waste fuel quality parameters (eg. H ₂ , H ₂ O, Ash)	.....		
	h) Flue gas temperature at boiler outlet	.....		
	i) Ambient air temperature	.....		
	v) Curve indicating departure			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 1 OF 14

CLAUSE NO.	BIDDER'S NAME			
1.02.00	from Nucleate Boiling for each furnace wall			
	vi)	ID,FD & PA fan stall lines, equal efficiency lines, system resistance lines with all fans in service at 50 Hz and 47.5 Hz respectively showing the 100% BMCR, 100% TMCR, 80% TMCR Test Block and other load points		
	xi)	Temperature characteristics of the superheaters with load		
	xii)	Characteristic curves showing the acid dew point temperature Vs. Sulphur content, moisture content in the fuel and percentage of excess air		
	xiii)	Comprehensive information design basis and calculations for the furnace cooling factor, Proposed Heat Liberation Rate, Max. Net heat Input per unit plan area of the furnace, furnace residence time, Burner zone heat release rate and other design parameters of the proposed design and how they are arrived at		
	xiv)	Characteristic curves for air flow meters (differential pressure vs flow)		
	Supplementary Data			
	i)	A complete list of all the equipment requiring the following shall be furnished indicating parameters, continuous requirement and the maximum requirement		
	a)	Auxiliary steam	Minimum	Normal
		Continuous	.....	.....
	Intermittent	.....	.....	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL-STEAM GENERATOR)	PAGE 2 OF 14

CLAUSE NO.	BIDDER'S NAME			
		Hot	Warm	Cold
	Start up	.....	.....	.....
	b) Cooling water	.....		
	c) Service air	.....		
	d) Instrument air	.....		
	e) Number and electrical rating of A.C. and D.C. power supply feeders at available voltage for each of control & Instrumentation system in Bidder's Scope	.....		
	ii) A detailed list of steam generator auxiliaries with the respective continuous power consumption (in KW of each auxiliary)	.....		
	iii) Complete schedule of motors giving voltage, KW rating (calculated and installed capacity) service factor, etc.	.....		
	iv) Complete valve schedule giving design conditions, normal working conditions, pressure drop across valves, type, body/trim material, pressure and temperature rating, make, size etc.	.....		
	Requirement of actuator alongwith KW rating shall also be furnished	.....		
	v) Pressure Parts			
	a) Details of furnace construction	.....		
	b) Details of Drum	.....		
	c) Details of economiser, superheater	.....		
	d) Details of other pressure vessels like flash tank etc.,	.....		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 3 OF 14	

CLAUSE NO.	 BIDDER'S NAME		
	e) Details of safety valves f) Weight, water volume, and dimensions including tube size, materials, and spacing of all components in a,b,c, items vi) Mode of erection sequence and other relevant particulars in respect of installation of: a) Structural Steel b) Pressure parts c) Rotating and static equipment d) Ducting e) and others, as applicable vii) Details of recommended procedures for welding and erection viii) A comparison and history of all steam generators in service of similar design and size to that proposed, including description of operating difficulties experienced and design changes made of eliminate difficulties ix) Complete fuel firing equipment description x) Complete description and functional write-up of the furnace safe guard and supervisory system and secondary air damper control system and general arrangement and cutout details of console inserts with bill of materials xi) General arrangement and write-up on flue gas to air heaters / SCAPH giving details & instrumentation (same shall also be		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL-STEAM GENERATOR)	PAGE 4 OF 14

CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	furnished for tubular air heaters in case they are offered as an alternative) xii) Soot blowing system description complete with control system write-up, console, mimic diagram and logic panel, general arrangement and cut-out drawing. xiii) General description of air & flue gas ducts and dampers xiv) Recommended functional block diagrams with write-ups for each control loop required for safe and efficient steam generator operation xv) A complete list of instruments, sensing devices and control equipment integral, local gauge board, local instrument rack, enclosure, local panel mounted, CER mounted, loose instruments to be mounted on Units. Control Panel/ Board covered in the proposal with type, make, accuracy, range, connection sizes, contact details, dial size etc. in the Bidder's scope xvi) Write up on interlocks and protections with logic diagrams xvii) Complete write up of structural design concepts and buck stay design calculations xviii) Complete write-up on the method of fuel flow control and maintaining desired operating temperature and residence time in the boiler xix) Start-up and shutdown procedures xx) Start-up diagrams which will show the following quantities plotted w.r.t. time from			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 5 OF 14

CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	ignition of oil burner to 100% BMCR (full fuel flow 400 TPD) a) Oil fuel input b) Main fuel input c) Drum pressure and temperature d) Feed water flow e) Steam flow through superheater f) Primary superheater outlet temperature g) Intermediate superheater outlet temperature h) Superheater attemperator spray water flow i) Final superheater outlet temperature j). Secondary burner oil input l) Total time in minutes m) Ramp rate n) Grate stoker speed (if applicable) (The required start up diagrams shall be for a cold start, hot start and a warm start. Shutdown conditions for overnight and weekend shutdowns shall also be specified so that the fastest warm start up rates may be obtained). xxi) Limiting condition if any for quick starting and loading for cold, warm and hot start xxii) a) Schedule of valves with full particulars of valves and their actuators (for powered valves) such as type, make, motor rating/ pneumatic consumption, limit & torque switch details, time for full opening / closing			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 6 OF 14

CLAUSE NO.	BIDDER'S NAME	
	etc. b) Schedule of control valves giving type and make of valves and actuators, size, body and trim material etc. stroke length, stroking time and full technical particulars of valves and their actuators and associated accessories c) Schedule of dampers and vanes with full particulars of dampers and their actuators, (for powered dampers) such as type of actuator, make, torque rating, stroke and stroking time, electrical rating/ pneumatic consumption limit and torque switch position transmitter details etc. including details of associated accessories. xxiii) List of special maintenance tools included in the proposal xxiv) Complete description and functional write-ups with necessary diagrams and schemes elaborating pressure and temperature controls, interlocks, etc. and cutout and over all dimensions, details of console and list of console mounted items, local instruments, accessories, etc. in respect of Aux. PRDS. xxv) List of insert panels, control cabinets and local control panels included in the proposal with GA drawings, mounting and cutout details xxvi) List of flow elements covered in the proposal with full particulars such as design details data sheets, make and dimensions xxvii) List of locally mounted junction boxes included in the proposal	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)
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CLAUSE NO.	BIDDER'S NAME	
	xxviii) Instrument and control equipment to be made available for light up & steam blowing xxix) Temperature sensors calibration standards xxx) Boiler GA drawing for marking instrument tapping points xxxi) Particulars of prefabricated & other cables xxxii) Electromatic impulse safety valve functional write-up type make & cutout details of the remote control station (if applicable) xxxiii) Boiler tube metal Thermo-couple details, number, type, make etc. a) Water wall b) SH xxxiv) Pressure and temperature for instruments xxxv) Detailed description of Elevators xxxvi) Write-up on interlocks and safety devices for elevators xxxvii) Schedule of motors xxxviii) Write-up on chemical cleaning of boiler with schemes xxxix) Write-up on the superheater temperature control with waste fuel / oil firing xxxx) Write up on the boiler variable and constant pressure operations (if applicable) xxxxi) Detailed write-up with supporting technical literature and calculations on the method proposed to limit NOx emis-	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 8 OF 14

CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	sion (both thermal NOx and fuel NOx) Bidder to detail the changes (if any) in the proposed steam generator design to achieve NOx level xxxxii) Complete list of grate wear parts with material and anticipated life of each part xxxxiii) Logic diagrams describing system functions for all controls and protections xxxxiv) Complete bill of materials including all hardware items/ equipments and accessories for combustion control xxxxv) Confirm that all additional hardware and software over and above those indicated in the proposal section and bill of material, if required during detailed engineering stage for fully meeting the intent and requirements of the specification (both functional and parametric) shall be furnished with in the quoted price. (This is essential since Bidder has full responsibility on system completeness) xxxxvi) Power distribution single line diagram giving capacity and ratings of feeders xxxxvii) Calculations for total heat load predicated for panels and controls integral with SG . xxxxviii) Description of design features provided in the system which enable compliance with SWC requirements specified L) Description of shop and site tests and test procedures for panels and controls in SG Scope Description of the facilities available with the Bidder for	..... ..... ..... ..... ..... ..... ..... ..... .....		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 9 OF 14

CLAUSE NO.	BIDDER'S NAME 
	conducting elevated temperature test and SWC test as per specifications. The Bidder shall provide details and results of the tests conducted for similar systems if the Bidder has conducted such tests in the past Li) Complete description and functional write-up with diagram & schemes elaborating the acoustic pyrometer detection system offered Lii) Technical details of pitot tube including calibration curves Liii) Write-up, scheme calculations, curves with list and calibration of thermocouples (In case drum material call for stress evaluation of drum) Liv) Comprehensive information on basis of arriving at heat liberation rate, maximum net heat input per unit plan area of the furnace, furnace cooling factor, residence time etc. Lv) Criteria governing rate of loading /unloading of steam generator with particular reference to the thermocouples and their location on steam generator for establishing loading/unloading rate Lvi) Description of the design details operation philosophy etc. for steam generator start-up circulation as applicable. Lvii) Functional description, design details of grate system Lviii) List of temporary equipments supplied by Bidder for pre-commissioning activities including all piping, valves, fittings, instruments and chemicals etc.
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 10 OF 14

CLAUSE NO.	BIDDER'S NAME	
Lix) 1.03.00 1.03.01	Complete description and functional writeup elaborating the Boiler Maintenance work station features Drawings Steam Generator i) Plan of steam generator and its auxiliaries at ground floor level, at oil burner, grate, SNCR, feed hopper, ash extractor, drum level and at an intermediate level (preferably at the long retractable soot blower level), indicating the galleries, platforms and stairways. The plan drawing shall indicate the minimum distance recommended, from the last steam generator column to the steam generator enclosure ii) Front elevation, side elevation and cross section of the steam generating unit showing location of headers and drum iii) Layout of steam generator structural steel columns upto stack. These shall indicate the size of members and main dimensions, with design loadings and all lifting facilities for purposes of maintenance iv) Layout of interconnecting platforms with the lift and platform meant for connecting the steam generator floors to the turbine operating floor v) Preliminary layout of air and gas ducts showing damper location, manholes, expansion joints, supports etc. vi) Drawing for full gas tight dampers clearly indicating how sealing is effected and the gas tightness efficiency (on flow) is achieved	
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CLAUSE NO.	BIDDER'S NAME	एनटीपीसी NTPC
	vii) General arrangement drawings of the Bag filter, gas conditioning tower, lime / activated carbon dosing, system, storage including locations of various dampers / valves viii) Schematic drawings of the grate, feeding system, secondary and primary burner equipment. ix) General arrangement drawings showing arrangement of FD, ID, PA and GR (if applicable), SA fans (if applicable), burner air fan, burner sealing or sealing air fan, air heaters, ducting arrangement between the boiler and the bag filter with dimensions and weight. x) Arrangement drawings showing arrangement, dimensions, pitching, supporting arrangement, clearances etc. for the pressure parts. xi) Schematic diagram indicating and instrumentation and controls integral with Steam Generator circuits clearly indicating pipe-duct size (OD's and ID's), operating parameters, maximum fluid velocities, insulation thickness and material specifications of main steam piping type of actuators. a) Steam flow b) Feed water flow c) Blow down d) Vents and Drains e) Air, fuel and flue gas f) Grate system g) High pressure chemical dosing h) Fuel oil system in the	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 12 OF 14

CLAUSE NO.	BIDDER'S NAME				
1.03.02		boiler area and burner system for oil fuel	.....		
	i)	Fuel oil system for secondary burner	.....		
	j)	Lubrication system of fans, fan motors and any other equipment	.....		
	k)	SCAPH / air heaters	.....		
	l)	Auxiliary steam system	.....		
	m)	Cooling water	.....		
	n)	Service Air	.....		
	o)	Instrument air	.....		
	xii)	Drawings of drum with preliminary dimensions and indicating stubs locations and details for local and remote instruments and controls	.....		
	xiii)	General arrangement drawing of the boiler maintenance cradle (s) and sketches showing how the cradles will be introduced, assembled and lifted up for maintenance, step by step	.....		
	xiv)	Drawings showing number and locations of temporary and permanent thermocouples	.....		
	xv)	General arrangement of boiler showing location of the probes of acoustic steam leak detection system (as applicable)	.....		
	xvi)	GA & Foundation Drawings of all Boiler Auxiliaries like fans/ grate etc.	.....		
		Boiler and Duct Supporting Columns			
	i)	Location Plan: Details of location and arrangement . scheme of columns, embedments and fixing details, sizes			
	KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 13 OF 14

CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	of pedestals, levels, blocknuts & anchor bolts and channels indicating scope of supply of Bidder. ii) Loading on foundations :Axial load, bending moments and shear forces transmitted to foundation for following loading combinations separately indi- cating Ash loading considered per design. a) Dead load b) Live load c) Wind load d) Seismic load e) Temperature load iii) Complete bracing arrang- ement for boiler and combi- nations of (+ve) and (-ve) forces for the seismic or wind (whichever is governing) iv) Percentage of the load considered for calculating wind and seismic forces 			
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.00.00 2.01.00	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN	
	ANTICIPATED PERFORMANCE DATA UNDER STIPULATED GUARANTEE CONDITIONS General i) Steam flow at superheater outlet (Tonnes/hr) ii) Steam pressure at superheater outlet (kg/cm ²) abs iii) Steam temperature at superheater outlet (degC) x) Feed water temperature (deg.C) xi) Steam generator efficiency based on the HHV of design fuel xii) Heat liberated by fuel per unit furnace volume (kcal/m ³ /hr) (if applicable) xiii) Furnace cooling factor (kcal/m ² /hr) (if applicable) xiv) Burner zone heat release rate (kcal/m ² /hr) (if applicable) xv) Plan area heat release rate (kcal/m ² /hr (if applicable) xviii) Weight of fuel fired (tonnes/hr) xix) Furnace exit gas temperature (deg.C) xx) Steam Purity at SH outlet (ppm) a) Total dissolved solids b) Silica c) Sodium	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL-STEAM GENERATOR)

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.02.00 2.02.01 2.02.02 2.02.03	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	d) Chlorides	.....
	e) Copper	.....
	f) Iron	.....
	xxi) Furnish thermal load diagram and adjustment factor considered	.....
	Temperature (deg. C)	
	Air	
	Design Ambient	.....
	Inlet to the APH (Primary air)	.....
	Outlet of APH (Primary air)	.....
	Inlet to the APH (Secondary air)	.....
	Outlet of the APH (Secondary air)	.....
	Secondary air at Inlet to grate	.....
	Hot Primary air in the common duct before grate	.....
	Hot primary air at the inlet to grate	.....
	Fuel & air mixture	
	i) Fuel and air mixture in the grate	.....
	Flue Gases (Actual Temperatures)	
	iii) Theoretical combustion temperature in the combustion zone	.....
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 2 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)		
	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN		
	iv) At furnace arch level (Furnace arch level is defined as the level at the entrance to radiant super heater.)	.....	.....	
	v) At Furnace arch exit (as defined in the specification for FEGT)	.....	.....	
	vi) Entrance to superheater			
	Stage I	.....	.....	
	Stage II	.....	.....	
	Stage III	.....	.....	
	vii) Exit of Superheater			
	Stage I	.....	.....	
	Stage II	.....	.....	
	Stage III	.....	.....	
	x) Entrance of economiser	.....	.....	
	xi) Exit of economiser	.....	.....	
	xii) Entrance to primary air heater	.....	.....	
	xvi) Exit of primary air heater (Uncorrected)	.....	.....	
	xix) Entrance of bag filter	.....	.....	
	xx) Exit of bag filter	.....	.....	
	xxi) Entrance of ID fans	.....	.....	
	xxii) Entrance to Chimney	.....	.....	
2.02.04	Feed Water			
	iii) Water entering economiser	.....	.....	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 3 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.02.05	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	iv) Water leaving economiser	.....
	v) Desuperheating spray water temperature	
	a) Superheater	.....
	Steam	
	iii) Inlet of superheater	
	1st Stage	.....
	2nd Stage	.....
	3rd Stage	.....
	iv) Outlet of superheater	
	1st Stage	.....
	2nd Stage	.....
	3rd Stage	.....
	vii) Outlet of drum	.....
2.03.00	Pressure	
2.03.01	Air (mmwc)	
	i) Forced draft fan silencer outlet	.....
	ii) Forced draft fan discharge	.....
	iii) Air heater inlet (Secondary air )	.....
	iv) Air heater outlet (Secondary air)	.....
	v) Before grate (Secondary air)	.....
	vi) Primary air fan inlet	.....
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 4 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)	एनडीपीसी NTPC
2.03.03	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN		
	vii) Primary air fan discharge	.....	.....
	viii) Air heater inlet (Primary air)	.....	.....
	ix) Air heater outlet (Primary air)	.....	.....
	x) Hot primary air in the common duct before grate	.....	.....
	xi) Cold primary air header	.....	.....
	xii) Hot primary air at the inlet to grate	.....	.....
	Feed Water (kg/cm²) abs		
	i) Inlet to economiser (at the specified terminal point)	.....	.....
	ii) At Economiser inlet	.....	.....
	iii) Outlet of Economiser	.....	.....
	iv) Attenuation water for superheater	.....	.....
2.03.04	Drum Pressure (Kg/cm²) abs.	.....	.....
2.03.05	Steam (kg/cm²)(abs)		
	Inlet of superheater	.....	.....
	Outlet of superheater	.....	.....
	Inlet of drum	.....	.....
	Outlet of drum	.....	.....
2.04.00	Pressure Drop		
2.04.01	Air Path: (mmwc)		
	i) Primary air circuit		
	a) In air ducts including bends dampers, vanes etc.	.....	.....
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL-STEAM GENERATOR) PAGE 5 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)		
	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN		
	b) Across aerofoil (flow measuring device)	.....	.....	
	c) Across APH	.....	.....	
	d) Total loss through the system	.....	.....	
2.04.02	Fuel Path (mmwc)			
	i) Across the grate	.....	.....	
2.04.03	Flue Gas Path (mmwc)			
	i) Furnace pressure (back draught)	.....	.....	
	ii) Across SH convection path	.....	.....	
	iii) Across economisers	.....	.....	
	iv) Across air heaters	.....	.....	
	v) In gas ducts			
	a) Between boiler outlet and bag filter funnel inlet	.....	.....	
	b) Between outlet of bag filter & inlet of ID fan	.....	.....	
	c) Between ID fan outlet and chimney inlet	.....	.....	
	vi) Total loss through the system	.....	.....	
2.04.04	Steam Path (kg/cm²)			
	i) Saturated steam connections including horizontal and vertical hangers	.....	.....	
	ii) Superheater Stage I	.....	.....	
	iii) Superheater Stage II	.....	.....	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 6 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.04.05	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN	
	iv) Superheater Stage III v) Superheater desuperheater	
2.04.05	Feed Water Path (kg/cm²)	
2.05.00	i) Valves and connected piping	
	ii) Economiser	
2.05.00	Velocities (m/sec)	
	i) Grate throat gas velocity	
	ii) Maximum gas velocity through tube banks of economizer	
	iii) Minimum gas velocity through tube banks of economizer	
	Superheater	
	Stage I	
	Stage II	
	Stage III	
	Economiser	
	Stage I	
	Stage II	
	(provide for other economiser as well- if applicable)	
	iii) Gas/air velocities through the air heater heating elements	
	a) Gas	
	- Primay APH	
	- Secondary APH (if applicable).....	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 7 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.06.00	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN b) Air - Primary APH - Secondary APH(if applicable)..... iv) Air velocities a) Cold air ducts b) Hot air ducts v) Gas velocities in gas ducting sections a) AH to Eco. b) Boiler out to gas conditioning tower c) Boiler outlet to Bag filter d) Bag filter to ID fan e) ID fan to stack Percentage of Oxygen in flue gas i) At furnace exit ii) At economiser outlet iii) At air heater outlet (primary) v) In the duct before Bag filter vi) At bag filter outlet vii) At ID fan inlet	
	2.07.00 Flow rate of air (kg/hr) i) FD fan outlet ii) PA fan outlet iii) Air heater inlet a) Primary air	
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	b) Secondary air	.....
	iv) Air heater outlet	.....
	a) Primary air	.....
	b) Secondary air	.....
	v) Wall air / cooling air	.....
	vi) Total air to each section of grate	.....
	vii) Total combustion air	.....
2.08.00	Flow rate of flue gases (kg/hr)	
	i) Airheater inlet	.....
	iii) Airheater outlet	.....
	iv) Economiser outlet	.....
	v) Bag filter inlet	.....
	vi) Bag filter outlet	.....
	vii) ID fan inlet	.....
	viii) Recirculation gas flow (Applicable for the cases where gas recirculation is being used to control NOx /steam temperature)	.....
2.09.00	Excess Air (%)	
	i) At grate	.....
	ii) At furnace exit	.....
	iii) At economiser outlet	.....
	iv) At the air heater exit (primary)	
	vi) At Bag filter inlet	
	vii) At I.D. fan inlet	
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		PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.10.00	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN Leakages (Tonnes per hour) i) Primary air Ducts/Dampers ii) Secondary air Wind box Ducts/Dampers	
2.11.00	Heat Balance (based on GCV of design fuel fired) i) Total fuel fired (tonnes/hr) ii) Gross Calorific value of fuel (Kcal/kg) iii) Heat absorbed per kg. of fuel in a) Air preheaters (kcal) - Primary - Secondary b) Economiser (kcal) c) Superheater (kcal) Stage I Stage II Stage III Roof tubes Convective pass enclosure Steam cooled hanger tubes e) Water walls Wall tubing	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL-STEAM GENERATOR) PAGE 10 OF 16

CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)	
2.12.00	Provide data for all these loading conditions		
	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN		
	Screen tubes	.....	.....
	Any other	.....	.....
	iv) Total heat absorbed effectively by the unit (per kg of waste (kcal) be)	.....	.....
	Heat losses in the Steam Generator Heat losses in the Steam Generator		
	i) Heat loss due to flue gasses (%)	.....	.....
	- Dry gas loss	.....	.....
	- Hydrogen in the fuel	.....	.....
	- Moisture in the fuel	.....	.....
	- Moisture in the air	.....	.....
	- Total heat loss due to flue gases	.....	.....
	ii) Heat loss due to unburnt carbon (%) in:	.....	.....
	- Furnace bottom ash	.....	.....
	- Fly ash	.....	.....
	- Total heat loss due to unburnt carbon	.....	.....
	iii) Sensible heat loss (%) in:	.....	.....
	- Furnace bottom ash	.....	.....
	- Economiser hopper ash		
	- Air heater hopper ash		
	- Any other hopper ash (multi pass boiler)		
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
2.13.00	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	- Total sensible heat loss	.....
	iv) Heat loss due to radiation (%)	.....
	v) Unaccounted heat loss (%) (give details)	.....
	vi) Total heat losses {sum of the (i) to (v)}	.....
	vii) Heat credits (give details of equipment and breakup)	.....
	viii) Steam generator efficiency (%)	.....
	Weight and Distribution of Ash collected	
	i) Grate hopper (kg/hr)	.....
	ii) Economiser hopper (kg/hr)	.....
	iii) Air heater hopper (kg/hr)	.....
	iv) 2 / 3/ 4 pass boiler hoppers (kg/hr)	.....
	v) Gas conditioning hoppers (kg/hr)	.....
	vi) Bag filter hoppers (kg/hr)	.....
2.14.00	Furnace Design Data	
2.14.01	Net Heat Input	
	a) Heat input by oil fuel	.....
	b) Heat input by waste fuel	.....
2.14.03	Superheater Spray Quantity in T/hr.	
	a) Spray quantity	
2.15.00	Furnace Performance Data Description(As per Clause 1.05.01	
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)	एनटीपीसी NTPC
2.16.00	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN Section-VI, Part B Sub-section-A-02) i) Total heat duty (10^6 Kcal/hr) ii) Efficiency (%) iii) Total heat generated (10^6 Kcal/hr) iv) Net heat input (10^6 Kcal/hr) (Unburnt) v) Furnace Plan area (M^2) vi) Furnace EPRS (M^2) vii) Furnace Volume (M^3) viii) Net heat input/plan area (10^6 Kcal/ m^2 /hr) ix) Net heat input /EPRS (10^6 Kcal/ m^2 /hr) x) Volumetric Heat Release rate (10^6 Kcal/ m^2 /hr) xi) Furnace exit gas temp. (Deg.C) xii) Residence time* (Sec) * Bidder to furnish the residence time calculation along with the bid		
	Mass velocity in evaporator (kg/m^2 sec.) i) Maximum ii) Minimum		
2.17.00	Mass flow through (Kg/m^2 sec) i) Front water walls ii) Rear water walls iii) Side Walls		
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)
		
	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
2.18.00	Auxiliary Steam Consumption i) Steam conditions a) Pressure range (kg/cm ²) (abs) b) Temperature range (deg.C) ii) Steam coil air pre-heater (kg/hr)Max. a) Primary b) Secondary	
2.19.00	Start ups	
2.19.01	Recommended Startup time periods to bring steam Generator to full load from ignition (with HP bypass system) i) Cold start, (hours), ii) Warm start (hours) iii) Hot start (hours) iv) Time between start (hours) v) Hot restart after trip out with less than one hour shut down	
2.19.02	Number of start ups/life (Nos.) of following type for which the unit has been designed a) Cold startup b) Warm startup c) Hot startups	
2.21.00	SH drains during starting a) Flow rate of drain water from	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 14 OF 16		

CLAUSE NO.	BIDDER'S NAME		PERFORMANCE (GUARANTEE CONDITION)	
2.22.00	Provide data for all these loading conditions		LP 1, LP2, LP3, LP 4, LP5, LP DESIGN	
		primary superheater header (kg/hr)	.....	
	b)	Flow rate of drain water from SH final header (kg/hr)	.....	
	c)	Flow rate of drain water from SH final header (kg/hr)	.....	
	Wind box performance			
	i)	Free air area (M ²)	.....	
	ii)	Secondary air flow into the wind box (M ³ /sec)	.....	
	iii)	Secondary air density (kg/M ³)	.....	
	iv)	Secondary air temperature in the wind box (deg.C)	.....	
	v)	Secondary air velocity (M/sec)	.....	
	vi)	Differential pressure with respect to the furnace (mmwc)	.....	
	2.23.00	Combustion Data		
i)		Stoichiometric dry air required kg/kg fuel	.....	
ii)		Stoichiometric wet air required kg/kg fuel	.....	
iii)		Volume of flue gas at Eco outlet per Kg of Coal (NM ³)	.....	
iv)		Emissivity at mean firing zone (Correct upto fifth place of decimal)	.....	
a)		Flame Emissivity		
b)		Gas Emissivity		
c)		Total Emissivity		
v)		Specific heat of flue gases		
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CLAUSE NO.	BIDDER'S NAME	PERFORMANCE (GUARANTEE CONDITION)	एनटीपीसी NTPC
	Provide data for all these loading conditions at mean firing zone (correct upto fifth place of decimal) vi) Weight of flue gas produced by burning 1 kg of fuel (kg) at Eco outlet	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN 	
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CLAUSE NO.	BIDDER'S NAME						
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN						
3.00.00	ANTICIPATED PERFORMANCE DATA OF GRATE AND STEAM GENERATOR FOR FUEL BASED ON DIFFERENT OPERATING CONDITION (RANGE OF MSW FUEL)						
3.01.00	General						
	i)	Steam flow at superheater outlet (Tonnes/hr)	.....	.....	.....	.....	.....
	ii)	Steam pressure at super-heater outlet (kg/cm²) abs	.....	.....	.....	.....	.....
	iii)	Steam temperature at superheater outlet (degC)	.....	.....	.....	.....	.....
	ix)	Control point (% MCR)	.....	.....	.....	.....	.....
	x)	Feed water temperature (deg.C)	.....	.....	.....	.....	.....
	xi)	Steam generator efficiency based on the HHV of design fuel	.....	.....	.....	.....	.....
	xii)	Heat liberated by fuel per unit furnace volume (kcal/m³/hr)	.....	.....	.....	.....	.....
	xiii)	Furnace cooling factor (kcal/m²/hr)	.....	.....	.....	.....	.....
	xiv)	Burner zone heat release rate (kcal/m²/hr)	.....	.....	.....	.....	.....
	xv)	Plan area heat release rate (kcal/m²/hr)	.....	.....	.....	.....	.....
	xviii)	Weight of fuel fired (tonnes/hr)	.....	.....	.....	.....	.....
	xix)	Furnace exit gas temperature (deg.C)					
	xx)	Steam Purity at SH outlet (ppm)					
	a)	Total dissolved solids					
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CLAUSE NO.	BIDDER'S NAME 			
3.02.00 3.02.01	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN			
	b) Silica 			
	c) Sodium 			
	d) Chlorides 			
	e) Copper 			
	f) Iron 			
	xxi) Furnish calculations for plan area heat release rate, burner zone heat release rate, volumetric heat release rate furnace cooling factor & heat input per burner alongwith details of EPRS calculation, basis for the fouling factor/surface adjustment factor considered 			
	Temperature (deg.C)			
	Air			
	iii) Design Ambient 			
	iv) Inlet to the APH (Primary air) 			
	v) Outlet of APH (Primary air) 			
	vi) Inlet to the APH (Secondary air) 			
	vii) Outlet of the APH (Secondary air) 			
	viii) Secondary air at Inlet to grate 			
	ix) Hot Primary air in the common duct before grate 			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9		PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 2 OF 16

CLAUSE NO.	BIDDER'S NAME 
3.02.03	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN x) Hot primary air at the inlet to grate Flue Gases (Actual Temperatures) iii) Theoretical combustion temperature in the combustion zone iv) At furnace arch level (Furnace arch level is defined as the level at the entrance to radiant super heater.) v) At Furnace arch exit (as defined in the specification for FEGT) vi) Entrance to superheater Stage I Stage II Stage III vii) Exit of Superheater Stage I Stage II Stage III x) Entrance of economiser xi) Exit of economiser xii) Entrance to primary air heater xiii) Entrance to secondary air heater
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 3 OF 16

CLAUSE NO.	BIDDER'S NAME				
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN				
3.02.04	xix) Entrance of bag filter	.....	.....	.....	.....
	xx) Exit of bag filter	.....	.....	.....	.....
	xxi) Entrance of ID fans	.....	.....	.....	.....
	xxii) Entrance to Chimney	.....	.....	.....	.....
	Feed Water				
	Water entering economiser	.....	.....	.....	.....
	Water leaving economiser	.....	.....	.....	.....
	Desuperheating spray water temperature				
	a) Superheater	.....	.....	.....	.....
3.02.05	Steam				
	iii) Inlet of superheater				
	1st Stage	.....	.....	.....	.....
	2nd Stage	.....	.....	.....	.....
	3rd Stage	.....	.....	.....	.....
	iv) Outlet of superheater				
	1st Stage	.....	.....	.....	.....
	2nd Stage	.....	.....	.....	.....
	3rd Stage	.....	.....	.....	.....
	vii) Outlet of drum				
3.03.00	Pressure				
3.03.01	Air (mmwc)				
	i) Forced draft fan silencer outlet				
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CLAUSE NO.	BIDDER'S NAME					
3.03.03	Provide data for all these loading conditions					LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	ii)	Forced draft fan discharge	.....	.....	.....	.....
	iii)	Air heater inlet (Secondary air )	.....	.....	.....	.....
	iv)	Air heater outlet (Secondary air)	.....	.....	.....	.....
	v)	In grate windbox (Secondary air)	.....	.....	.....	.....
	vi)	Primary air fan inlet	.....	.....	.....	.....
	vii)	Primary air fan discharge	.....	.....	.....	.....
	viii)	Air heater inlet (Primary air)	.....	.....	.....	.....
	ix)	Air heater outlet (Primary air)	.....	.....	.....	.....
	x)	Hot primary air in the duct before grate	.....	.....	.....	.....
	xi)	Cold primary air header	.....	.....	.....	.....
	xii)	Hot primary air at the inlet to grate	.....	.....	.....	.....
	Feed Water (kg/cm²) abs					
	i)	Inlet to economiser (at the specified terminal point)	.....	.....	.....	.....
	ii)	At Economiser inlet	.....	.....	.....	.....
iii)	Outlet of economiser	.....	.....	.....	.....	
iv)	Attemperation water for superheater	.....	.....	.....	.....	
3.03.04	Drum Pressure (Kg/cm²) abs.					
3.03.05	Steam (kg/cm²)(abs)					
	i)	Inlet of superheater				
	ii)	Outlet of superheater				
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CLAUSE NO.	BIDDER'S NAME				
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN				
3.04.00	vi) Outlet of drum	.....	.....	.....	.....
	Pressure Drop				
3.04.01	Air Path: (mmwc)				
	i) Primary air circuit				
	a) In air ducts including bends dampers, vanes etc.	.....	.....	.....	.....
	b) Across aerofoil (flow measuring device)	.....	.....	.....	.....
	c) Across APH	.....	.....	.....	.....
	d) Total loss through the system	.....	.....	.....	.....
3.04.02	Fuel Path (mmwc)				
	i) Across grate	.....	.....	.....	.....
3.04.03	Flue Gas Path (mmwc)				
	i) Furnace pressure (back draught)	.....	.....	.....	.....
	ii) Across SH convection path	.....	.....	.....	.....
	iii) Across economisers	.....	.....	.....	.....
	iv) Across air heaters	.....	.....	.....	.....
	v) In gas ducts				
	a) Between air heater outlet and Bag filter inlet	.....	.....	.....	.....
	b) Between outlet of bag filter & inlet of ID fan	.....	.....	.....	.....
	c) Between ID fan outlet and chimney inlet				
	vi) Total loss through the system				
3.04.04	Steam Path (kg/cm²)				

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CLAUSE NO.	BIDDER'S NAME				
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN				
	i)	Saturated steam conn- ections including horizontal and vertical hangers	.....	.....	.....
	ii)	Superheater Stage I	.....	.....	.....
	iii)	Superheater Stage II	.....	.....	.....
	iv)	Superheater Stage III	.....	.....	.....
	v)	Superheater desuperheater	.....	.....	.....
3.04.05	Feed Water Path (kg/cm²)				
	i)	Valves and connected piping	.....	.....	.....
	ii)	Economiser	.....	.....	.....
3.05.00	Velocities (m/sec)				
	i)	Furnace throat gas velocity	.....	.....	.....
	ii)	Maximum gas velocity through tube banks of TSH	.....	.....	.....
	iii)	Maximum gas velocity through tube banks of economiser			
	a)	Superheater			
		Stage I			
		Stage II			
		Stage III			
	c)	Economiser			
		Stage I			
		Stage II			

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CLAUSE NO.	BIDDER'S NAME				
3.06.00	Provide data for all these loading conditions				LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	iii)	Gas/air velocities through the air heater heating elements			
	a)	Gas			
		- Secondary APH	.....	.....	.....
		- Primary APH	.....	.....	.....
	b)	Air			
		- Secondary APH	.....	.....	.....
		- Primary APH	.....	.....	.....
	iv)	Air velocities			
	a)	Cold air ducts	.....	.....	.....
	b)	Hot air ducts	.....	.....	.....
	v)	Gas velocities in gas ducting sections			
	a)	AH to Eco	.....	.....	.....
	b)	Eco. gas bypass ducts	.....	.....	.....
	c)	Eco to Bag filter	.....	.....	.....
	d)	Bag filter to ID fan	.....	.....	.....
	e)	ID fan to stack	.....	.....	.....
Percentage of Oxygen in flue gas					
i)	At furnace exit	.....	.....	.....	
ii)	At economiser outlet				
iii)	At air heater outlet (primary)				
iv)	At air heater outlet (secondary)				
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CLAUSE NO.	BIDDER'S NAME 			
3.07.00	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN			
	v) Inlet of Bag filter vi) At bag filter outlet vii) At ID fan inlet Flow rate of air (kg/hr) i) FD fan outlet ii) PA fan outlet iii) Air heater inlet a) Primary air b) Secondary air iv) Air heater outlet a) Primary air b) Secondary air v) Cool air / Wall air vi) Total air to grate vii) Total combustion air			
3.08.00	Flow rate of flue gases (kg/hr) i) Primary Airheater inlet ii) Secondary Airheater inlet iii) Primary airheater outlet iv) Secondary airheater outlet v) Bag filter inlet vi) Bag filter outlet vii) ID fan inlet viii) Recirculation gas flow			
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CLAUSE NO.	BIDDER'S NAME					एनटीपीसी NTPC
	Provide data for all these loading conditions					LP 1, LP2, LP3, LP 4, LP5, LP DESIGN
	(Applicable for the cases where gas recirculation is being used to control NOx and steam temperature)					
3.09.00	Excess Air (%)					
	i)	At grate	.....	.....	.....	
	ii)	At furnace exit	.....	.....	.....	
	iii)	At economiser outlet	.....	.....	.....	
	iv)	At the air heater exit (primary)	.....	.....	.....	
	v)	At the airheater exit (secondary)	.....	.....	.....	
	vi)	At Bag filter inlet	.....	.....	.....	
	vii)	At I.D. fan inlet	.....	.....	.....	
3.10.00	Leakages (Tonnes per hour)					
	i)	Primary air				
		a) air preheater	.....	.....	.....	
		b) Ducts/Dampers	.....	.....	.....	
	ii)	Secondary air				
		a) air heater	.....	.....	.....	
		b) Wind box	.....	.....	.....	
		c) Ducts/Dampers	.....	.....	.....	
3.11.00	Heat Balance (based on GCV of Design fuel fired)					
	i)	Total fuel fired (tonnes/hr)				
	ii)	Gross Calorific value of fuel (Kcal/kg)				
	iii)	Heat absorbed per kg.				
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CLAUSE NO.	BIDDER'S NAME 			
3.12.00	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN			
	of fuel in	.....	.....	.....
	a) Air preheaters (kcal)	.....	.....	.....
	- Primary	.....	.....	.....
	- Secondary	.....	.....	.....
	b) Economiser (kcal)	.....	.....	.....
	c) Superheater (kcal)	.....	.....	.....
	Stage I	.....	.....	.....
	Stage II	.....	.....	.....
	Stage III	.....	.....	.....
	Roof tubes	.....	.....	.....
	Convective pass enclosure	.....	.....	.....
	Steam cooled hanger tubes	.....	.....	.....
	e) Water walls	.....	.....	.....
	Wall tubing	.....	.....	.....
	Screen tubes	.....	.....	.....
	Any other	.....	.....	.....
	iv) Total heat absorbed effectively by the unit (per kg of fuel (kcal) be)	.....	.....	.....
3.12.00	Heat losses in the Steam Generator Heat losses in the Steam Generator shall be quoted for guarantee conditions also:			
	i) Heat loss due to flue gasses (%)			
	- Dry gas loss			
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CLAUSE NO.	BIDDER'S NAME 
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN - Hydrogen in the fuel - Moisture in the fuel - Moisture in the air - Total heat loss due to flue gases ii) Heat loss due to unburnt carbon (%) in: - Furnace bottom ash - Fly ash - Total heat loss due to unburnt carbon iii) Sensible heat loss (%) in: - Furnace bottom ash - Economiser hopper ash - Air heater hopper ash - Bag filter hopper ash - Total sensible heat loss iv) Heat loss due to radiation (%) v) Unaccounted heat loss (%) (give details) vi) Total heat losses {sum of the (i) to (v)} vii) Heat credits (give details of equipment and breakup) viii) Steam generator efficiency (%)
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 12 OF 16

CLAUSE NO.	BIDDER'S NAME						
	Provide data for all these loading conditions					LP 1, LP2, LP3, LP 4, LP5, LP DESIGN	
3.13.00	Weight and Distribution of Ash collected						
	i)	Furnace bottom hopper (kg/hr)	.....	.....	.....	.....	.....
	ii)	Economiser hopper (kg/hr)	.....	.....	.....	.....	.....
	iii)	Multi pass boiler hopper (kg/hr)	.....	.....	.....	.....	.....
	iv)	Bag filter hoppers (kg/hr)	.....	.....	.....	.....	.....
3.14.00	Furnace Design Data						
3.14.01	Net Heat Input						
	a)	Net heat input	.....	.....	.....	.....	.....
3.14.03	Superheater Spray Quantity in T/hr.						
	a)	Spray quantity	.....	.....	.....	.....	.....
3.15.00	Furnace Performance Data						
	Description (As per Clause 1.05.01 Section-VI, Part B, Sub-section-A-02)						
	i)	Total heat duty (10 ⁶ Kcal/hr)	.....	.....	.....	.....	.....
	ii)	Efficiency (%)	.....	.....	.....	.....	.....
	iii)	Total heat generated (10 ⁶ Kcal/hr)	.....	.....	.....	.....	.....
	iv)	Net heat input (10 ⁶ Kcal/hr) (Unburnt)	.....	.....	.....	.....	.....
	v)	Furnace Plan area (M ²)	.....	.....	.....	.....	.....
	vi)	Furnace EPRS (M ²)	.....	.....	.....	.....	.....
	vii)	Furnace Volume (M ³)	.....	.....	.....	.....	.....
	viii)	Net heat input/plan area (10 ⁶ Kcal/m ² /hr)	.....	.....	.....	.....	.....
	ix)	Net heat input /EPRS (10 ⁶ Kcal/m ² /hr)					
	x)	Volumetric Heat Release rate (10 ⁶ Kcal/m ² /hr)					
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CLAUSE NO.	BIDDER'S NAME 
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN xi) Furnace exit gas temp. (Deg.C) xii) Residence time* (Sec) * Bidder to furnish the residence time calculation along with the bid 3.16.00 Mass velocity in evaporator tubes (Kg/m² sec.) i) Maximum ii) Minimum 3.17.00 Tube Mass Velocity (Kg/m²sec.) i) Front water walls ii) Rear water walls iii) Side Walls 3.18.00 Auxiliary Steam Consumption i) Steam conditions a) Pressure range (kg/cm²) (abs) b) Temperature range (deg.C) ii) Steam coil air pre-heater (kg/hr)Max. a) Primary b) Secondary 3.19.00 Start ups 3.19.01 Recommended Startup time periods to bring steam Generator to full load from ignition (with HP bypass system)
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 14 OF 16

CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	Provide data for all these loading conditions	LP 1, LP2, LP3, LP 4, LP5, LP DESIGN		
3.19.02	i)	Cold start, (hours)	.....	
	ii)	warm start, (hours)	.....	
	iii)	Hold start, (hours)	.....	
	Number of start ups/life (Nos.) of following type for which the unit has been designed			
	i)	Cold start, (hours)	.....	
	ii)	warm start, (hours)	.....	
3.21.00	iii)	Hold start, (hours)	.....	
	SH drains during starting			
	a)	Flow rate of drain water from primary superheater header (kg/hr)	.....	
	b)	Flow rate of drain water from SH final header (kg/hr)	.....	
	c)	Flow rate of drain water from SH final header (kg/hr)	.....	
	Wind box performance			
3.22.00	i)	Free air area (M ²)	.....	
	ii)	Secondary air flow into the wind box (M ³ /sec)	.....	
	iii)	Secondary air density (kg/M ³)	.....	
	iv)	Secondary air temperature in the wind box (deg.C)	.....	
	v)	Secondary air velocity (M/sec)	.....	
	vi)	Differential pressure with respect to the furnace (mmwc)		
3.23.00	Combustion Data			
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CLAUSE NO.	BIDDER'S NAME 		
	Provide data for all these loading conditions LP 1, LP2, LP3, LP 4, LP5, LP DESIGN i) Stoichiometric dry air required kg/kg fuel ii) Stoichiometric wet air required kg/kg fuel iii) Volume of flue gas at Eco outlet per Kg of fuel (NM³) iv) Emissivity at mean firing zone (Correct upto fifth place of decimal) a) Flame Emissivity b) Gas Emissivity c) Total Emissivity v) Specific heat of flue gases at mean firing zone (correct upto fifth place of decimal) vi) Weight of flue gas produced by burning 1 kg of fuel (kg) at Eco outlet 		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 16 OF 16

CLAUSE NO.	BIDDER'S NAME 
8.00.00 8.01.00	STEAM GENERATOR AND PRESSURE PARTS General i) Manufacturer ii) Location Outdoor (Inside the Acoustic enclosure) iii) Operation Base load/Cyclic iv) Design Code v) Type of firing vi) Type of grate & steam generator vii) Total auxiliary power (kW) consumption at Different load points viii) Not used ix) Minimum load at which: (a) Steam generator can be operated continuously with complete flame stability g without gas (b) Steam generator can be operated continuously with complete flame stability with gas xii) Fuel oil for start-up xiii) Maximum continuous throughput xiv) Percentage load change per minute from full load to 60 % load without exce- eding limits on unburnt combustibles or NOx while maintaining safe flame conditions. xv) Total water content of the steam generator for hydraulic test (Tonnes) xvi) Time required for draining the complete steam gene- rator when it is an atmos- pheric pressure (minutes) xvii) Maximum load after that no oil support is required (%) xix) Details of permanent thermocouples giving the number and their
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 1 OF 19

CLAUSE NO.	BIDDER'S NAME		
8.02.00	location	.....	
	xx) Write up on Furnace safe guard and supervisory system (FSSS)	.....	
	xxi) Acid dew point temperature (°C)	Coal.....	Oil
	xxii) Margin over the acid dew point temperature adopted (°C)	Coal.....	Oil
	xxiii) Total cooling water required for all the boiler auxiliaries assuming inlet temperature of 33 and 36 deg.C. (M³/hour)	.....	
	xxiv) Recommended inter locks and protections of the boiler auxiliaries	.....	
	xxv) Submit evidence to support adequacy of design proposed considering furnace slagging, cold end corrosion, erosion, superheater fouling, hot end corrosion, etc.	.....	
	Furnace		
	i) Type	.....	
	ii) Wall	Water/steam cooled	
	iii) Bottom	Dry	
	iv) Draft	Balanced	
	v) Tube arrangement	Membrane/Inclined	
	vi) Explosion/implosion withstand capacity (mmwg)	.....	
	vii) Residence time for fuel particles in the furnace (to be supported with calculations) (Seconds)	.....	
	viii) Effective volume used to calculate the residence time (M³)	.....	
	ix) Adiabatic temperature of combustion used to calculate residence time (°C)		
x) Height from top of furnace			
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CLAUSE NO.	BIDDER'S NAME एनडीपीसी NTPC			
8.03.00	bottom ash hopper to furnace roof (M) xi) Depth (M) xii) Width (M) xiii) Furnace area (M²) a) Plan area b) EPRS (effective projected radiant surface) area (M²) of 1) Front water wall 2) Rear water wall 3) Side water wall 4) SH with Applicable section wise 5) RH with applicable section wise 6) Total (1 to 5) Bidder should indicate the break up of total EPRS area in the above format. He should not indicate just the total EPRS area. Bidder shall indicate the name of various sections also. xiv) Furnace volume (M³) xv) Furnace temperature probe a) Type b) Manufacturer c) Quantity d) Size e) Location			
	Water Walls	Front wall	Rear wall	Side wall
	i) Numbers of tubes			
	ii) Outside diameter (mm)			
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CLAUSE NO.		BIDDER'S NAME			एनटीपीसी NTPC	
8.03.03	iii)	Design thickness (mm)				
	iv)	Pitch				
	v)	Actual thickness				
	vi)	Design standard	.....	.....	.....	
	vii)	Material	.....	.....	.....	
	viii)	Oxidation temperature of material (degree Celsius)	.....	.....	.....	
	ix)	Total projected surface area of tubes (M²)	.....	.....	.....	
	x)	Method of joining long tubes	.....	.....	.....	
	xi)	Method of attachment to drum	.....	.....	.....	
	xii)	Method of joining headers	.....	.....	.....	
	xiii)	Total weight of tubes (kg)	.....	.....	.....	
	xiv)	Design pressure of tubes (Kg/cm²)	.....	.....	.....	
	xv)	Maximum pressure of tubes (kg/cm²)	.....	.....	.....	
	xvi)	Design metal temperature deg.C	.....	.....	.....	
	xvii)	Erosion allowance provided on tube thickness (mm)	.....	.....	.....	
	xviii)	Provision of fabricated tubes as per Sub-section-A02, Part-B, Section-VI.		Yes/No		
	xvix)	Details of the water wall tube ribbing / rifling with dimensioned sketch.	.....	.....	.....	
	xix)	Angle of inclination of water wall tubes	.....	.....	.....	
	xx)	Number and type of thermo-couples fitted to water wall tubes				
		Furnace Surface Adjustment Factors				
i)	Front wall					
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
8.04.00	ii)	Side walls		
	iii)	Rear walls		
	iv)	Roof		
	Water Wall Headers			
	i)	Number of headers		
	ii)	Height of the lowest header above the ground level (M)		
	iii)	Outside diameter (mm)		
	iv)	Design thickness (mm)		
	v)	Actual thickness provided (mm)		
	vi)	Length of each header (M)		
	vii)	Design standards		
	viii)	Total weight of headers (kg)		
	ix)	Maximum header unbalance		
	x)	Design pressure of header (Kg/sq.cm)(abs)		
8.05.00	xi)	Maximum working pressure of headers (Kg/sq.cm)(abs)		
	xii)	Material specification		
	xiii)	Oxidation temperature of material (degree Celsius)		
	xiv)	Flow unbalance in each header w.r.t. average flow (%)		
	Drum			
	i)	Number		
	ii)	Construction		
	iii)	Material specification and composition		
</				

CLAUSE NO.	BIDDER'S NAME			
	iv)	Oxidation temperature of material (degree Celsius)	.....	
	v)	Manufacturer of plate material	.....	
	vi)	Composition	.....	
	vii)	Ultimate tensile strength of plates (Kg/cm²)	.....	
	viii)	Design pressure (Kg/cm²)	.....	
	ix)	Design metal temperature (deg C)	.....	
	x)	Design stress at working metal temperature (0.2% proof stress)	.....	
	xi)	Max. allowable working pressure	.....	
	xii)	Design standard	.....	
	xiii)	Design thickness for straight portion (mm)	.....	
	xiv)	Design thickness for dished ends (mm)	.....	
	xv)	Actual thickness used for straight portion (mm)	.....	
	xvi)	Actual thickness used for dished ends (mm)	.....	
	xvii)	Overall length of separator (as applicable) (mm)	.....	
	xviii)	Outside diameter of separator (as applicable) (mm)	.....	
	xvix)	Internal diameter (mm)		
	xx)	Corrosion allowance (mm)		
	xxi)	Elevation of separator centre line (mm)		
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CLAUSE NO.		BIDDER'S NAME			एनटीपीसी NTPC	
8.06.00	xxii)	Shroud material				
	xxiii)	Max. permissible temperature differential between any two parts of the (deg.C)				
	a)	During Normal operation	.....			
	b)	During accelerated starting	.....			
	xxiv)	Water capacity at MCR Conditions (in seconds) between normal and lowest water level permitted	.....			
	xxv)	Separator weight with internals	.....			
	xxvi)	Separator weight without internals	.....			
	Purity of Saturated Steam leaving the separator (ppm)					
	i)	Total dissolved solids	.....			
	ii)	Silica content	.....			
	iii)	Sodium	.....			
	iv)	Chlorides	.....			
	v)	Copper	.....			
	vi)	Iron	.....			
	vii)	Moisture	.....			
8.07.00	Superheater					
8.07.01	Superheater					
		Stage I	Stage II	Stage III		
i)	Type (Radiant/Convection)					
ii)	Platen, (drainable/non-drainable)					
iii)	Pendant (drainable/non-					
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CLAUSE NO.	BIDDER'S NAME			
	drainable)			
iv)	Horizontal headers (drainable/non-drainable)			
v)	Material specification and composition	.....	.....	.....
vi)	Oxidation temperature of materials (degree Celsius)	.....	.....	.....
vii)	Effective heating surface area (M²)	.....	.....	.....
viii)	Total circumferential heating surface area (M²)	.....	.....	.....
ix)	Gas flow path area (M²)	.....	.....	.....
x)	Depth of each bank on the direction of the gas flow (mm)	.....	.....	.....
xi)	Clear space between the two bank in the direction of gas flow (mm)	.....	.....	.....
xi)	Maximum steam gas side metal temperature (deg.C)	.....	.....	.....
xii)	Maximum gas side metal temperature (deg.C)	.....	.....	.....
xiii)	Type of flow (counter or parallel)	.....	.....	.....
xiv)	Material of tube support (Composition)	.....	.....	.....
xv)	Design standard	.....	.....	.....
xvi)	Design tube thickness (mm)	.....	.....	.....
xvii)	Outside diameter (mm)	.....	.....	.....
xviii)	Actual thickness used (mm)			
xix)	Margin on tube thickness (mm)			
xx)	Effective length (m)			
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CLAUSE NO.		BIDDER'S NAME				
		xxi)	Gross length (per one tube) (m)			
		xxii)	Number of elements/section			
		xxiii)	Total number of tubes	.....	.....	.....
		xxiv)	Tube pitch			
		a)	Parallel to gas flow (mm)	.....	.....	.....
		b)	Across gas flow (mm)	.....	.....	.....
		xxv)	Furnace Radiation penetration features	.....	.....	.....
		xxvi)	Method of joining long tubes	.....	.....	.....
		xxvii)	Total weight of tubes (Kg)	.....	.....	.....
		xxviii)	Maximum average flue gas velocity in SH section/tube banks with transverse pitching 600 mm or less and with 25% excess air at economiser outlet for the range of specified coals and loads. (m/sec) (Refer clause 1.05.04, sub- section-A 02, Part B, Section VI)	.....	.....	.....
		xxix)	Number and type of thermo- couples fitted to superheater tubes	.....	.....	.....
		a)	In gas path	.....	.....	.....
		b)	In pent house	.....	.....	.....
		xxix)	Reference Drawings	.....	.....	.....
8.07.02			Not used.			
8.08.00			Headers	Superheater		
		i)	Material specification	.....	.....	.....
		ii)	Oxidation temperature of materials (degree Celsius)			
		iii)	Location : (Outside/Inside gas path			
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CLAUSE NO.	BIDDER'S NAME एनडीपीसी NTPC
8.09.00 8.09.01	iv) Maximum operating pressure (kg/cm²)(abs) v) Design pressure (kg/cm²) (abs) vi) Design standard vii) Outside diameter (mm) viii) Thickness (mm) ix) Length (m) x) Whether any diaphragm is used in any header and if so give details xi) Details of final outlet header connection xii) Method of internal inspection xiii) Total weight (kg) xiv) Total volume (M³) xv) Maximum header unbalance Superheater Temperature Control Superheater attemperator i) Type ii) Number of stages of attemperation iii) Position in steam circuit iv) Specification of material v) Superheater steam temperature range that can be maintained between 50% TMCR to 100% of boiler MCR (deg C.) vi) Spray nozzle material vii) Maximum spray water flow
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 10 OF 19

CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
			rate and corresponding steam output and the coal being fired (kg/hr)		.....
	viii)		Min. spray water rate and corresponding steam output and the coal being fired (kg/hr)		.....
	ix)		Reference Drawing		.....
8.09.02	Not Used.				
8.09.03	Not Used.				
8.10.00	Economiser				
	i)		Type (Plain, Drainable, Non-steaming, inline tube arrangement)		.....
	ii)		Material specification and composition		.....
	iii)		Oxidation temperature of material		.....
	iv)		Manufacturer		.....
	v)		Water side effective heating surface area (M²)		.....
	vi)		Gas side effective heating surface area (M²)		.....
	vi)		Gas flow path area (M²)		.....
	vii)		Maximum average flue gas velocity through the economiser tube banks in accordance with criteria specified in clause 1.05.05, sub-section- A02, Part B, Section VI. (m/sec)		.....
	viii)		Maximum localised flue gas velocity through the economiser tube banks in accordance with criteria specified in clause 1.05.05, sub-section- A02, Part B, Section VI. (m/sec)		
	ix)		Heat transfer co-efficient (gas to water) at 100% MCR		
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC		
	x)	Provisions made for erosion shields/cassettes baffles as per requirement of relevant clause 8.02.00 of sub-section- A03, Part B, Section VI. (Enclose arrangement drawing)	YES/NO			
	xi)	Provision made for economiser on load cleaning	YES/NO			
	xii)	Provisions of space has been kept for future addition as per relevant clause 8.04.00 of sub-section- A03, Part B, Section VI.	YES/NO			
	xiii)	Design pressure of tubes (kg/cm2) (abs)	.....			
	xiv)	Outside diameter tubes (mm)	.....			
	xv)	Design tube thickness used (mm)	.....			
	xvi)	Actual thickness used and margin on tube thickness provided (mm)	.....			
	xvii)	Length of tubes (m)	.....			
	xviii)	Pitch along gas flow (mm)	.....			
	xvix)	Pitch across gas flow (mm)	.....			
	xx)	Design standard	.....			
	xxi)	Total weight of tube (Kg)	.....			
	xxii)	Total internal volume of tubes (M³)	.....			
	xxiii)	Total number of tubes				
	xxiv)	Type of tube joints				
	xxv)	Tube support				
		a) Type				
		b) Material				
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
		xxvi)	Maximum steam gas side metal temperature (deg.C)		
		xvii)	Maximum gas side metal temperature (deg.C)	.....	
		xviii)	Minimum temperature of feed water that economiser can handle safely (degC)	.....	
		xix)	Headers		
		a)	Material specification	.....	
		b)	Outside diameter (mm)	.....	
		c)	Design Thickness (mm)	.....	
		d)	Actual thickness used (mm)	.....	
		e)	Length (m)	.....	
		f)	Design standard	.....	
		g)	Type of construction	.....	
		h)	Method of internal inspection	.....	
		i)	Maximum header unbalance	.....	
		j)	Total weight (kg)	.....	
		k)	Design pressure (kg/cm ²) (abs)	.....	
		l)	Maximum working Pressure (kg/cm ²)(abs)	.....	
		m)	Total Internal volume (M ³)	.....	
8.11.00	Boiler Mountings and Fittings				
8.11.01	Drum Safety Valves (for each safety valve)				
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE			TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9		PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)
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CLAUSE NO.	एनडीपीसी NTPC BIDDER'S NAME		
8.11.02	i) Manufacturer ii) Type and rating iii) Number iv) Specification of material a) Body b) Trim/spring c) Seat v) Set Pressure (kg/cm ²)(abs) vi) Flow capacities (kg/hr) vii) Type of end connections		
	Superheater Safety Valves (for each safety valve) i) Manufacturer ii) Type and rating iii) Number iv) Specification of material a) Body b) Trim/spring c) Seat v) Set Pressure (kg/cm ²)(abs) vi) Flow capacities (kg/hr) vii) Type of end connections		
8.11.03	Not used		
8.11.04	Electromatic Relief Valve S.H. outlet (if applicable) i) Manufacturer		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 14 OF 19

CLAUSE NO.	BIDDER'S NAME			एनडीपीसी NTPC
8.12.00	ii)	Type and actuator		
	iii)	Number		
	iv)	Location		
	v)	Size		
	vi)	Capacity (kg/hr)		
	Drum level gauges			
8.13.00	i)	Manufacturer		
	ii)	Type		
	iii)	Number		
	iv)	Location		
	v)	Size		
	Flow Meters (for all the flow meters / flow nozzles)			
8.14.00	i)	Service		
	ii)	Pressure drop (kg/cm ²)		
	iii)	Material		
	iv)	Nozzle/orifice plate		
	v)	Maximum flow (kg/hr)		
	vi)	Type of end connections (welded flanged)		
8.14.00	D.M. Water for boiler filling : Volume (M³)			
	i)	Circulating system consisting of separator waterwall panels Headers etc.		
	ii)	Economiser system		
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CLAUSE NO.		BIDDER'S NAME		एनडीपीसी NTPC		
8.15.00	iii)	Super heater system (From separator upto Final SH outlet header)				
	iv)	Reheater system (From RH inlet header to outlet header)	.....			
	Main Steam Line					
	i)	Material specification	.....			
	ii)	Oxidation temperature of materials (degree Celsius)	.....			
	iii)	Maximum operating pressure (Kg/cm ²) (abs)	.....			
	iv)	Design pressure (kg/cm ²) (abs)	.....			
	v)	Design standard	.....			
	vi)	Outside diameter (mm)	.....			
	vii)	Thickness (mm)	.....			
8.16.00	Auxiliary Steam Pressure Reducing & Desuperheating Station		Main Steam PRDS			
	i)	Pressure Reducing valves				
		Manufacturer	.....			
		No. of valves	.....			
		Flow capacity of each valve (tonnes/hr)	.....			
		Type of valve	.....			
		Type of actuator				
		Body and trim material				
		Body design:				
		a) Pressure (kg/cm ²)				
		b) Temperature (deg.C)				
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CLAUSE NO.	BIDDER'S NAME			एनडीपीसी NTPC
	ii)	Desuperheaters		
		Manufacturer		
		Type		
		Flow capacity (tonn/hr)		
		Desuperheating water		
		a) Pressure (kg/cm ²)		
		b) Temperature (deg.C)		
		c) Quantity (kg/hr)		
	iii)	Pressure control valves (on spray water line)		
		Manufacturer		
		No. of valves		
		Flow capacity of each valve (tonnes/hr)		
		Type of valve		
		Type of actuator		
		Body and trim material		
		Body design:		
		a) Pressure (kg/cm ²)		
		b) Temperature (deg.C)		
	iv)	Temperature control valve (on spray water line)		
		Manufacturer		
		No. of valves		
		Flow capacity of each valve (tonnes/hr)		
		Type of valve		
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
8.17.00		Type of actuator			
		Body and trim material			
		Body design:	.....	.....	
		a) Pressure (kg/cm²)	.....	.....	
		b) Temperature (deg.C)	.....	.....	
	v)	Isolating valves (on steam and spray lines)			
		Manufacturer	.....	.....	
		No. of valves	.....	.....	
		Flow capacity of each valve (tonnes/hr)	.....	.....	
		Type of valve	.....	.....	
		Type of actuator	.....	.....	
		Body and trim material	.....	.....	
		Body design:	.....	.....	
		a) Pressure (kg/cm²)	.....	.....	
		b) Temperature (deg.C)	.....	.....	
		Drain Receiving vessel			
	i)	Dimensions	.....		
	ii)	Volume (m3)	.....		
	iii)	Operating pressure (kg/cm²)(abs)	.....		
	v)	Storage capcity of vessel for storing drains inaccordance with clause 1.05.18.02,Sub-Section-A02, Part B,Section VI. (minutes)			
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	vi)	Material		
	vii)	Thickness (mm)		
8.18.00	Not used			
8.19.00	Not Used			
8.20.00	Condensate Transfer Pumps (if applicable for SCAPH drain)			
	i)	No. of Pumps		
	ii)	Pump speed		
	iii)	Pump design capacity (Tonnes/hr.)		
	iv)	Maximum discharge pressure (kg/cm ² abs)		
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CLAUSE NO.	BIDDER'S NAME	एनटीपीसी NTPC		
		CHAPTER - III		
		TECHNICAL INFORMATION / DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT		
1.00.00		STEAM GENERATOR WITH AUXILIARIES		
1.01.00		Performance Data-Sizing calculations/Performance Curves/Diagrams		
		Contractor shall submit/furnish all relevant drawings/documents required to conform design requirements as elaborated in technical specifications. Some of the drawings/documents required are listed below,however, the list is not exhaustive. Contractor to submit all the related drawings/documents which shall be necessary to substantiate design requirements and other requirements to ensure compliance to specification requirements:		
a)		Design/sizing calculations including data sheets covering following (as a minimum): 1. Heat duty calculation 2. Air & Gas weight calculation 3. Furnace performance & sizing calculations 4. Furnace Residence Time calculation 5. Performance for design at different load point LP1 to LP 5 and LP design point 6. Boiler efficiency calculation 7. Duct design data and calculations 8. Fan sizing calculation and performance curves for FD/ID/PA/SA fans & scanner air fan 9. Air heater sizing calculation & equipment data 10. Steam coil air heater selection & sizing data/calculation 11. Gas system sizing/equipment data 12. Pressure parts schedule along with tube metal temperature calculations for xv) Evaporator, SH, Economiser and associated circulation system xvi) Circulation calculation xvii) Insulation Thickness calculations xviii) Safety valve sizing & selection xix) ERV Sizing (if applicable), selection & setting		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL DATA SHEETS SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-III SUB-SECTION:DM1	PAGE 1 OF 15

CLAUSE NO.	BIDDER'S NAME			
b)	Performance Data-Curves/Diagrams			
	i) Furnace temperature Vs fuel input ii) MSW fuel and fuel gas consumption Vs load. iii) Boiler start-up curves including the cold and hot start conditions. iv) Characteristic curves of the various auxiliary equipment such as fans, pumps, motors, fuel burners. etc. v) Complete technical literature including characteristics curves, data sheets, sizing calculations, for all control valves, process valves and flow measuring devices. vi) Characteristic curves of all actuators is respect of valves and dampers vii) Characteristic curves showing the pressure drop at various boiler outputs for the sections. a) between the economiser inlet and boiler drum b) between the drum and superheater outlet viii) Characteristic curves for the motor showing: a) Torque-speed b) Current - speed c) Current-time d) Locked rotor withstand curves (hot and cold) e) Thermal withstand curves (hot and cold)			
1.02.00	Other Data			
	i) Description of the method to be adopted for protection of the equipment during manufacture, shipment and storage at site. ii) Shipping breakdown of all equipments. iii) Technical documents clearly bringing out the features of design and construction of the components, parts of all equipments and systems furnished. iv) Inspection for erection, testing, commissioning, operation and maintenance of all equipments.			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL DATA SHEETS SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-III SUB-SECTION:DM1	PAGE 2 OF 15

CLAUSE NO.	BIDDER'S NAME			
	v)	A complete list of all auxiliary equipment and accessories furnished.		
	vi)	Schedule of valves and fittings schemewise along with complete tabulated data.		
	vii)	Final schedule and data sheets of actuators (Schemewise) for isolating and regulating valves, dampers and vanes incorporating the following particulars together with switch and circuit diagrams for each type of actuator:		
	a)	Manufacturer of actuator		
	b)	Type and drive		
	c)	Type, size (kW) and speed (rpm) of the motor		
	d)	Starting current of motor (amps)		
	e)	Full load current of motor (amps)		
	f)	Number of position limit switches provided for open position.		
	g)	Number of position limit switches provided for close position.		
	h)	Torque switch for full open position, if provided.		
	i)	Torque switch for full close position, if required.		
	j)	Number of auxiliary limit switches for indication and interlocks.		
	k)	Space heater, if provided. for limit switch compartment with its voltage and capacity		
	l)	Time for fully, opening and closing of the valves/dampers/vanes (seconds).		
	m)	Number and type of position transmitters provided for remote indication		
	n)	Resistance value of the position transmitter site wire Ohms)		
	o)	Remote position indicators, if any, for panel mounting with dimensional and cutout details.		
	p)	Input signal.		
	q)	Number and details of positioners provided		
	r)	Details of connecting linkages, limit switches, position transmitters, wire failure brake, supporting stand mounted or directly operated etc.		
	s)	Type-rating, and voltage of solenoid valve.		
	t)	Type and make of electro-pneumatic convertors, wherever required.		
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CLAUSE NO.	BIDDER'S NAME	एनटीपीसी NTPC		
	u) Input signal voltage and frequency, for electropneumatic converter, wherever required. ix) Pressure parts drawing and detailed stress calculations specially bringing out the calculations taking care of fatigue and creep stresses developed due to start up/shut downs specified. x) Desuperheater location and details xi) Scheme, write-up and drawings for: a) Superheater and temperature control system b) Soot blowing system pressure control. xii) Details of specification of insulating materials including the procedure for applying insulation, reinforcement, cladding sheet finishing method, curing setting etc. xiii) Calculation for thermal insulation thickness and thickness envisaged for various parts of steam generator and piping. xiv) Cross sectional drawing of steam generators showing the gas velocities in M/s for each tube bank, duct and breaching and gas temperature entering various key locations at 100% boiler MCR. xv) Details of all isolating dampers including gas tight dampers. xvi) Description and details of the recommended mill rejects disposal system. xvii) Details of the procedure followed for preservation of the boiler after chemical cleaning up to the commissioning time. xviii) List of lubricants, their specifications and the respective quantities covered under the specification. xix) Operating instructions for Control and Instrumentation schemes and equipments. xx) Final list of annunciation giving the suggested set values of parameters, contact configurations, ratings and other details. xxi) Final schedule of all local instruments and primary sensing devices furnished as part of this package with the value (normal and maximum) of the associated parameters, location, manufacturer, type range, accuracy, dial size, connection details and contact details such as ratings, number and configuration. xxii) Final write up in respect of control schemes of soot blowers, lub oil system for the bearings of fans/air heaters, electromatic impulse safety valve, secondary air control etc. xxiii) Final write up on interlocks and protections for furnace safeguard supervisory system including burner management and mill automation and recommended interlocks and			
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CLAUSE NO.	BIDDER'S NAME			
		protections for the boiler and its auxiliaries including suggested block interlock diagrams. xxiv) List of signalling contacts/impulses for the FSSS and other systems furnished as apart of the equipment for connection to the data logger, annunciation and interlocking and protection system (DDCMIS) xxv) Final list of insert panels, cabinets and local panels furnished, together with the cable schedules, wiring diagrams, interconnection diagrams and the cable specifications. GA drawing, mounting and cutout details for panels, consoles etc. xxvi) Details of A.C. and D.C. feeders and corresponding power requirements indicating number and capacity of feeder at available voltage for each equipment system and control like soot blowers, electromatic impulse safety valves, furnace safeguard and supervisory system etc. xxvii) Complete list of tapping points provided on the equipment pipe lines/ducts etc. for all instruments and controls. The list shall also cover the sizes of ducts/pipelines wherever they incorporate tapping points and piping diagrams and plant arrangement drawing to group instruments and size instrument enclosure. xxviii) Compressed air (station and instrument) quality requirements stating the parameters such as pressure, quality and quantity for the various equipments and actuators/deviced furnished. xxix) Cooling water requirements equipments wise stating the parameters such as pressure quality and flow rate. xxx) Complete details data sheets and connection details edge preparation drawings etc. and sizing calculations for flow elements and calibration curves, wherever necessary. xxxi) List and final local instruments transmitter sensors etc. with make, type range accuracy dial size and control details. xxxii) Final list of local instruments, transmitter sensors etc. with make type range, accuracy dial size and control details. xxxiii) Complete bill of materials for impulse piping root valves; penumatic copper tubings, fittings and other accessories. xxxvi) Details and drawing for vibration pads. xxxvii) Recommended list of digital and analogue inputs to the EMPLOYER's data Logger computer. xxxviii) Recommended list of indicators and recorders to be provided by the Employer on the unit control board giving their range, accuracy, parameters measured, with this normal and maximum values. xxxix) Details of:		
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CLAUSE NO.	BIDDER'S NAME			
1.03.00	a) Size of flue gas duct opening in the chimney shell & level of the centre line in the duct entering the chimney shell.			
	b) Fixing arrangement with chimeny.			
	c) Duct supporting columns.			
	d) Ducting design criteria and details			
	xxxx) Details of locations, loading, embedments & inserts if any:-			
	a) Between power house and boiler house.			
	b) Between ID and FD fans.			
	c) Between ID fan and chimney			
	xxxxi) Details of locations, loading and fixing for ID fan maintenance column.			
	xxxxii) Details of location, and fixing for foundations of blow down tanks.			
xxxxiii) Any other drawings/details for foundation of blow down tanks.				
Contract drawing requirements				
The drawing listed below shall be submitted by the successful Bidder in six (6) copies together with a polyester reproducible.				
i) Drawings of proposed equipments showing the arrangement details and dimensions.				
ii) Drawings indicating the final loading data, locations and fixing details of the equipment on their foundations.				
iii) Final low diagrams for steam, feed water, blowdown drains, vents and lub oil system for equipments requiring forced lubrication indicating the size of piping valves, flow nozzles and supports, instrumentation and controls and test tapping points etc.				
iv) Piping drawings detailing the layout piping location, loading details, location of valves, flow nozzles and supports, instrumentation and controls and test tapping points etc.				
v) Final scheme diagrams clearly indicating all dampers, control valves, valve actuators, instruments, parameters, duct/pipe size, scope of the Bidder for the following.				
a) Air and flue gas flow				
b) MSW fuel handling and firing system				
c) Fuel gas system				
d) Fuel gas burner system				
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CLAUSE NO.	BIDDER'S NAME			
	e) Air heaters f) Flue gas conditioning tower g) Bag filter vi) Drawing showing layout o draft plant including FD & ID fans, their drives and control mechanisms. vii) Layout of grate, waste pit, MSW hopper, feeders, P.A. fans and seal air fans. viii) Final scheme diagram in respect of cooling water, service air and instrument air. ix) Arrangement and layout of soot blowing system x) Arrangement details of fuel gas firing equipments. xi) Arrangement details of high pressure chemical dosing system xii) Arrangement and layout of boiler integral piping xiii) Erection assembly drawings xiv) Drawings showing the scheme and arrangement of equipment for chemical cleaning and steam blowing of steam generator. xv) Arrangement and layout of platforms and galleries. xvi) Drawings showing arrangement of maintenance runway beams and trolleys. xvii) Electrical interconnecting diagrams xviii) Drawing showing the table terminal details of auxiliary motors. xix) Diagram indicating the loading on power house and bunker structure columns of the main building due to the interconnections between the boiler operating floor and the main building structures. xx) Drawing showing the recommended interconnection details between the furnace bottom and the bottom ash hopper			
2.00.00	ELEVATORS			
2.01.00	Performance and other data			
	i) Detailed data of foundations for equipments, loading data, locations . Data shall include breaking of load on guides, reactions of buffers on lift pits, reaction on support points in machine room, hoistway etc.			
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CLAUSE NO.	BIDDER'S NAME				
2.02.00	ii)	Details of block outs, embedments inserts etc.			
	iii)	Write-up explaining the sequence of operation of control circuits and elevator components when an operation button is pressed.			
3.00.00	Contract Drawing Schedule				
	i)	General Arrangement and clearance drawings showing the general construction and dimensions of the equipment and complete structure.			
	ii)	Layout of the lift showing details of size and structure of lift well, plan of the machine room and lift pit.			
	iii)	Electrical control diagrams and detailed circuit diagrams and physical arrangement /location diagrams of various electrical components of the controller in the machine room, in the hoistway, in the car, at the landing etc.			
	iv)	Erection assembly drawings			
3.01.00	MOTOR				
3.01.00	The following technical data drawings and test certificate submitted by successful bidder. The actual schedule of these data drawings and test reports shall be mutually agreed to between Employer and successful bidder before the issue of award of contract.				
3.01.01	Drawing:				
3.01.02	a.	General arrangement and section drawings of motor indicating all the dimensions			
	b.	Terminal box details with shorting links etc. for stator leads space heater, RTd etc. (as applicable)			
	c.	Foundation details and fixing arrangements for all HT motors.			
	d.	Winding development diagrams for all T.T. motors			
	e.	Flow diagrams for lubricating oil and cooling system for all HT motor (as applicable)			
	f.	Motor sizing calculations			
3.01.02	Characteristic Curves				
	a.	Torque Vs speed characteristics of motor superimposed with that of driven equipment at rated voltage and at min. permissible starting voltage for all motors and at 103% rated speed.			
	b.	Starting time Vs current at rated voltage and at min permissible starting voltage for all motors.			
	c.	Load Vs efficiency Load Vs power factor, Load Vs current, Load Vs slip characteristic curves for all motors.			
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CLAUSE NO.	BIDDER'S NAME			
3.01.03	d.	Hot and cold thermal withstand curve for all motors.		
	e.	Heating and cooling time constant curves for H.T. Motors		
	f.	Type of insulation systems for HT Motors.		
	Test Certificate			
	Type of reports carried out on similar motors			
	3.01.04	Instruction manual for storage for prolonged duration, unpacking, handling at site, erection pre-commissioning test etc.		
	3.01.05	Technical Data		
	The following data shall be submitted by the contractor for each type and rating of the motor for Employer's approval.			
	3.01.05.1	Data for all motors		
	1.	Motor manufactures		
2.	Equipment driven by motor			
3.	Motor type			
4.	Frame size			
5.	Applicable standard to which motor confirms			
6.	Rated output t 50 deg. C air ambient / 38 deg C cooling water temp.			
7.	Maximum power input to the driven equipment at design duty point			
8.	Type of mounting			
9.	Class & type of insulation			
10.	Temp. rise at rated output condition at 50°C. air ambient/38 deg C cooling water temp. (by resistance method)			
11.	Type of enclosure, degree of protection & method of cooling.			
12.	a)	Rated voltage and frequency with variation		
	b)	Combined voltage frequency variation		
	c)	Minimum permissible starting voltage		
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CLAUSE NO.	एनटीपीसी NTPC BIDDER'S NAME
	13. i) Rated current ii) No load current 14. Rated speed 15. Efficiency at rated output (without -ve tolerance 16. P. F. at rated output, at starting and at design duty points 17. Rated torque 18. Starting torque 19. Pull out torque 20. Starting current 21. Locked rotor KVA 22. Stator winding a) resistance per phase b) connection star/delta 23. Direction of rotation from driving end 24. Weight of motor 25. Type & make of bearing 26. Recommended lubricant for bearing 27. GD² value of motor 28. GD² value of load 29. Winding details a) no. of turns per coil b) size of wire 30. Starting time with drive attached a) at rated voltage b) at min permissible starting voltage

CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
3.05.02	31.	No load starting time			
	a)	at rated voltage			
	b)	at min permissible staring voltage			
	32.	Terminal box			
	a)	Location/Position			
	b)	Type of stator winding connection is star/delta			
	c)	No. of terminals brought out			
	d)	Size of cable gland			
	e)	Size of copper lug			
	f)	Max. size of recommended/accommodable cable			
	g)	Fault level withstand capacity (For breaker operated motors only)			
	33.	Space heater			
	a)	Quantity			
	b)	Location			
	c)	Rated voltage			
d)	Rated wattage				
e)	Terminal box location				
34.	Type of coupling between motor & driven equipment				
35.	Guaranteed running life in hours for bearings.				
Additional data to be furnished for motors of >125 kW only.					
1.	Max. power input to the driven equipment at design duty point.				
2.	Max. power input to the driven equipment at rated speed over entire operating range.				
3.	Max. power input to the driven equipment at 103% of rated speed over entire operating range.				
4.	Max. power input to the driven equipment in the event of tripping of operating fans/pumps, where parallel operation of fans/pumps are envisaged.				
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
3.05.03.	5.	Temp. rise at rated output condition			
	i)	RTD method			
	ii)	Resistance method			
	6.	Method of cooling			
	7.	No. of permissible starts when motor is in cold condition			
	8.	No. of permissible starts when motor is in hot condition			
	9.	Heating time constant			
	a.	Stator			
	b.	Rotor			
	10.	Cooling time constant of stator and motor			
	a.	under standstill condition			
	b.	under running condition			
	11.	Max. permissible temp. of rotor			
	12.	Cold withstand time			
	a.	at rated voltage			
b.	at minimum permissible starting voltage				
13.	Hot withstand time				
a.	at rated voltage				
b.	at minimum permissible starting voltage				
14.	Minimum cooling time required to give one start incase of tripping followed by two hot starts				
3.05.03.	Additional data to be furnished for HT motors				
1.	Type of insulation system				
2.	Type of stator lead termination				
3.	RTD for winding				
a.	RTD's provided				
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CLAUSE NO.	BIDDER'S NAME			
	b. Location of RTD terminal box c. Rating of terminal block d. Resistance at 20 deg.C e. Type of RTD f. Make. 4. RTD for bearings a. No of RTD terminal box b. Location of RTD terminal box c. Rating of terminal block d. Resistance at 20 deg. C e. Type of RTD f. Make 5. Heat exchanger a. Type b. Make c. Mounting arrangement d. Dial type thermometer with alarm contact - Make - Type - Range - No. of contact & rating 6. Water cooled heat exchangers a. Cooling water type b. Cooling water flow c. Make type & range of flow switch			
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	d. Water leakage detector - Make - Type - Range - No. of contact & rating 7. Pedestal bearings a. Type of lubrication b. Oil pressure gauge/Oil pressure switch - Range and accuracy - No. of contacts & rating c. Whether oil flow indicator provided d. Motor driven pumps - No. of pumps - Motor KW rating - Voltage rating e. jacking Oil pump - Motor KW rating - Voltage rating f. Whether bearing insulation provided. 8. Surge withstand test particulars a. For main insulation i) Test voltage ii) Wave shape type (1.2/50m.sec.) b. For interturn insulation i) Test voltage			
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CLAUSE NO.	BIDDER'S NAME			
	ii) Wave shape type (.3/3 m.sec.) 9. High frequency over voltage test for coils a. Test voltage b. Test frequency			
4.00.00	INSTRUCTION MANUALS Contractor shall furnish twelve (12) copies of instruction manuals for all equipment which shall contain detailed step by step instruction for all operational and maintenance requirements. The manuals shall include among other information, the following aspects.			
4.01.01	Storage for prolonged duration			
4.01.02	Unpacking			
4.01.03	Erection			
4.01.04	Precommissioning tests			
4.01.05	Operating procedures			
4.01.06	Maintenance procedure and schedule.			
4.01.07	Precautions to be taken during operation and maintenance work.			
4.01.08	Outline dimension drawings showing relevant cross-sectional views and constructional features.			
4.01.09	Catalogue numbers of all components liable to be replaced during the life of the equipment.			
4.01.10	Rated voltage, current duty cycle and all other information which may be necessary for safe operation of equipment.			
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CLAUSE NO.	BIDDER'S NAME		
9.00.00 9.01.00	STEAM GENERATOR AUXILIARIES Air heater (Secondary air / Primary air) i) Manufacturer ii) Type iii) No. of air heaters iv) Mounting v) Maximum handling capacity (Nm³/hr) a) Flue gas air b) Air vi) Handling capacity at 100% BMCR load a) Flue gas air b) Air vii) Flue gas temperature at air heater outlet xiv) Total effective heating surface xvi) Casing material xvii) Casing thickness xviii) Pressure drop at 100% BMCR a) Air side b) Gas side xxii) Gas velocity at 100% BMCR xxiii) Air Velocity at 100% BMCR (m/sec)		
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CLAUSE NO.	BIDDER'S NAME						
9.01.01	xxiv)	Net free area for					
	a)	Gas flow (M²)					
	b)	Air flow (M²)					
	xxxi)	On load cleaning (if applicable)					
	xxxii)	Off load cleaning	Water jet/Air Jet				
	Air heater performance data with LP 1, LP2, LP 3, LP 4, LP 5 and LP Design						
	i)	Air flow rate (kg/hr)					
	a)	Entering APH					
		- Primary	.....	.....	.....	.....	
		- Secondary	.....	.....	.....	.....	
	b)	Leaving APH					
		- Primary	.....	.....	.....	.....	
		- Secondary	.....	.....	.....	.....	
	ii)	Flue gas flow rate (kg/hr)					
	a)	Entering Primary APH	.....	.....	.....	.....	
	b)	Leaving Primary APH	.....	.....	.....	.....	
	iii)	Flue gas flow rate (kg/hr)					
a)	Entering Secondary APH	.....	.....	.....	.....		
b)	Leaving Secondary APH	.....	.....	.....	.....		
9.02.00	vi)	Gas side pressure loss (mmwc)					
	a)	Primary APH					
	a)	Secondary APH					
9.02.00	Steam Coil Air Pre-Heaters						
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CLAUSE NO.	BIDDER'S NAME		एनडीपीसी NTPC
	i) Number of steam coil air preheaters ii) Type iii) Manufacturer iv) Mounting v) Shell side medium vi) Tube side medium vii) Quality of steam at entrance viii) Steam pressure (kg/cm²)(abs) ix) Steam temperature (deg.C) x) Design air flow (NM³/hr) xi) Normal air flow (NM³/hr) (MSW firing, Oil firing) xii) Air velocity (M/s (MSW firing, oil firing) xiii) Air inlet temperature (deg .C) xiv) Air outlet temperature (deg.C) xv) Quantity of steam correspondent to: a) Design air flow at 100% BMCR b) Normal air flow at 100% BMCR xvi) Pressure drop a) Air side (mmwg) MSW firing, oil firing) b) Steam side (mmwg) (MSW firing, oil firing) xvii) Drain a) Drain temperature b) Drain enthalpy (kcal/kg) gas gas Steam Steam..... 		

CLAUSE NO.	BIDDER'S NAME			
	xviii)	Total surface area (M ²)	.....	
	xix)	Overall Heat transfer co-efficient (Kcal/hr/M ² /deg.C)	.....	
	a)	Air side	.....	
	b)	Steam side	.....	
	xx)	Number of tubes	.....	
	xxi)	Construction features	.....	
	a)	Type of coil	.....	
	b)	Number of sections per heater	.....	
	c)	Length, width and height of each coil section (maximum)	.....	
	d)	Surface area of each section (M ²)	.....	
	e)	Disposition of coil sections and tube pitching	.....	
	f)	Shell design pressure (Kg/cm ²) (abs)	.....	
	g)	Coil design pressure (Kg/cm ²) (abs)	.....	
	h)	Tube diameter (mm)	.....	
	i)	Tube thickness (mm)	.....	
	j)	Steam inlet nozzles size (mm)		
	k)	Design standard		
	xxii)	Corrosion allowance (mm)		
	xxiii)	Material		
	a)	Tubes		
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CLAUSE NO.	एनडीपीसी NTPC BIDDER'S NAME			
9.03.00	b) Casing c) Fins d) Nozzles e) Baffles f) Impingement plates g) Flanges h) Headers i) Support plates j) Gaskets xxiv) Accessories (state whether provided/not provided) a) Local instruments b) Isolating valves c) Regulating valves d) Condensate collection tank e) Inter connected piping f) Instrument tapping points xxv) Metal weights xxvi) Upto what percentage of steam generator load the SCAPH is in operation xxvii) Reference drawing Draft Plant Forced draft fans Induced draft fans i) Manufacturer ii) Type iii) Number of fans per boiler iv) No. of blades/fan			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9		PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 5 OF 30

CLAUSE NO.	BIDDER'S NAME		
	v) Capacity a) Flow rate at 100% BMCR (M³/sec), design and corresponding temperature (degC) and density (kg/m³) b) Flow rate at design point (M³/sec), and corresponding temperature (deg.C) and density (kg/m³) c) Flow rate at 100% TMCR (M³/sec), design and corresponding temperature (degC) and density (kg/m³) d) Flow rate at 80% TMCR (M³/sec), design and corresponding temperature (degC) and density (kg/m³) e) Max. flow rate the fan can handle (M³/sec) and corresponding temperature (degC) and density (kg/m³) f) Min. flow rate the fan can handle (M³/sec) and corresponding temperature (degC) and density (kg/m³) vi) Static pressure a) Pressure at 100% BMCR (mmwc) design firing b) Pressure at design point (mmwc) c) Pressure at 100% TMCR design	Flow..... Temperature Density..... Flow..... Temperature Density..... Flow..... Temperature Density..... Flow..... Temperature Density..... Flow..... Temperature Density..... Flow..... Temperature Density..... 	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 6 OF 30

CLAUSE NO.	BIDDER'S NAME		
	firing (mmwc) d) Pressure at 80% TMCR design firing (mmwc) e) Shut off pressure (mmwc) f) Min. safe pressure (mmwc) vii) Design margin over and above design point for test block condition Forced draft fans Induced draft fans a) Flow rate (%) b) Pressure (%) viii) Synchronous speed of electric motor (rpm) ix) Normal Fan speed (rpm) x) Critical speeds a) First critical speed (rpm) b) Second critical speed (rpm) xi) Fan efficiency and Motor efficiency a) Design point b) LP 1 c) LP 2 d) LP 3 e) LP 4 f) LP 5 xiii) Direction of rotation facing fan coupling (clockwise or		
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 7 OF 30

CLAUSE NO.	BIDDER'S NAME			
		anticlokwise)	.....	
	xiv)	Impeller	.....	
	a)	Impeller diameter (mm)	.....	
	b)	Shaft diameter (mm)	.....	
	c)	Design tip speed of blades (M/sec)	.....	
	d)	Moment of Inertia of shaft and impeller	.....	
	xv)	Overall dimensions of fan & motor	.....	
	xvi)	Size of motor (KW)	.....	
	xvii)	Power Consumption at 100% BMCR (KW), design firing	.....	
	xviii)	Power Consumption at 100% TMCR (KW), design firing at motor terminal	.....	
	xix)	Power Consumption at 80% TMCR (KW), design firing at motor terminal	.....	
	xx)	Bearing and other mech-anical losses at BMCR (KW)	.....	
	xxi)	Total weight of fan and motor (tonnes)	.....	
	xxii)	Moment of Inertia of fan and motor	.....	
	xxiii)	Type of coupling	.....	
	xxiv)	Lubrication system for fan (forced/ring lubrication)	.....	
	xxv)	Lubrication system for motors (forced/ring lubrication)	.....	
	xxvi)	Features of construction	.....	
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 8 OF 30

CLAUSE NO.	BIDDER'S NAME			
	a) Blades with renewable wearing noses b) Mode of adjustment of gas flow control c) Range of control d) Type of casing e) Type of diffuser f) Blade angle variation xxvii) Material of construction and thickness a) Casing b) Casing side plates c) Casing Liner d) Impeller blade e) Inlet cone f) Outlet diffuser g) Impeller hub/shroud h) Impeller wear plate (if any) i) Coupling j) Base plate and foundation bolts k) Inlet vane xxviii) Bearings a) No. and make b) Type of Bearings c) Bearing liner material d) Method of lubrication			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 9 OF 30

CLAUSE NO.	BIDDER'S NAME			
	e)	Grade of lube oil	.....	
	f)	Thermometers provided	(Yes/No)	
	g)	Thermocouples provided	(Yes/No)	
	h)	Method of cooling the bearings (if not forced lubrication)	.....	
	xxix)	Shaft sealing arrangement	.....	
	xxx)	Hydraulic servo drive	.....	
	a)	Number, make and type	.....	
	b)	Type of oil seals	.....	
	c)	Material of cylinder piston and feed back system	.....	
	d)	Number of pumps	.....	
	e)	Number type and material of cooler	.....	
	f)	Pressure switches provided	(Yes/No) (Yes/No)	
	g)	Thermometers provided	(Yes/No) (Yes/No)	
	h)	Relief valves provided	.....	
	xxxi)	Lube oil system		
	a)	Number and type of pumps	.....	
	b)	Number and type of oil cooler	.....	
	c)	Relief valves provided	(Yes/No) (Yes/No)	
	d)	Pressure switches provided	(Yes/No) (Yes/No)	
	e)	Thermometers provided	(Yes/No) (Yes/No)	
	f)	Electric heater in the		
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CLAUSE NO.	BIDDER'S NAME			
9.04.00	oil tank		(Yes/No)	(Yes/No)
	xxxii)	Accessories		
	a)	Coupling guard provided	(Yes/No)	(Yes/No)
	b)	Base plate and found- dation bolts provided	(Yes/No)	(Yes/No)
	c)	Forced lubrication unit with pumps, filters, cooler, connected piping etc. provided	(Yes/No)	(Yes/No)
	d)	Hydraulic control unit with pumps, filters, cooler, connected piping etc. provided	(Yes/No)	(Yes/No)
	e)	Local instruments provided	(Yes/No)	(Yes/No)
	f)	Provision of vibration sensor made	(Yes/No)	(Yes/No)
	g)	RTD's for fan and motor bearings provided	(Yes/No)	(Yes/No)
	xxxiii)	Minimum load of fan at which it can operate in parallel without any knocking and bumping	.....	
	xxxiv)	Reference drawing numbers	.....	
	Note: In case of ID fans the maximum blade tip velocity and maximum allowable blade tip velocity and speed of the fan at various operating boiler loads shall be furnished alongwith the Bid.			
	Soot Blowers			
	i)	Manufacturer of		
a)	Blowers			
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	b) Control equipment ii) Type iii) Location (Outdoor) iv) Mounting (Horizontal) v) Cleaning medium vi) Parameters of cleaning medium a) Pressure (Kg/cm ²) (abs) b) Temperature (deg.C) vii) Source of cleaning medium viii) Number of groups of soot blowers ix) Total operating time per group x) Furnace & Superheater blowers Furnace Super heater a) Type and make b) Number of soot blowers c) Duration of operation (min) d) Operating Pressure (Kg/cm ²) (abs) e) Steam Consumption rate per blower (Kg/hr) f) Total time required for one complete cycle of soot blowing operation (min) g) Length of travel (mm) h) Blowing radius/angle			
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	i) Effective area blown by one soot blower (m ²)			
	j) Type of Electric Drive	Dual/Single Electric Drive		
	xi) Reheater & Economiser	Reheater	Economiser	
	a) Type and make			
	b) Number of soot blowers			
	c) Duration of operation (min)			
	d) Operating Pressure (Kg/cm ²) (abs)			
	e) Steam Consumption rate per blower (Kg/hr)			
	f) Total time required for one complete cycle of soot blowing operation (min)			
	g) Length of travel (mm)			
	h) Blowing radius/angle			
	i) Effective area blown by one soot blower (m ²)			
	j) Type of Electric Drive	Dual/Single Electric Drive		
	xii) Material			
	a) Lance / Swivel tube in high temperature area			
	b) Lance / Swivel tube in intermediate tempe- rature area			
	c) Lance / Swivel tube in low temperature area			
	d) Nozzle			
	e) Gland packing			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9	PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR)	PAGE 13 OF 30

CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	f)	Travelling carriage	.....	
	g)	Bearings in high temperature area	.....	
	h)	Bearings in intermediate temperature area	.....	
	i)	Bearings in low temperature area	.....	
	j)	Feed tube	.....	
	k)	Blowing head	.....	
	l)	Chain	.....	
	m)	Compression hangers	.....	
	n)	Bolts	.....	
	xiii)	Accessories provided		
	a)	Blowing head	Yes/No	
	b)	Pressure reducing valve	Yes/No	
	c)	Relief valve	Yes/No	
	d)	Orifices	Yes/No	
	e)	Travelling carriage	Yes/No	
	f)	Clamps (if required)	Yes/No	
	g)	Limit switches	Yes/No	
	h)	Gear boxes	Yes/No	
	i)	Speed reducer	Yes/No	
	j)	Supporting frame	Yes/No	
	xiv)	Location drawing of soot blowers	.....	
	xv)	Description of panels & system equipment offered		
	xvi)	Reference drawing Nos		
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
9.05.00	xvii)	Provision kept for installation of additional soot blowers in future (write-up and drawings furnished)			
	Note : Bidder furnished all the above soot blowers data depending on the type of boiler and arrangement of heat transfer surfaces in different format also (As applicable) down vessel				
	Atmospheric Flash Tank				
	i)	Design code		.....	
	ii)	Operating pressure (Kg/cm2) (abs)		.....	
	iii)	Design pressure (Kg/cm2) (abs)		.....	
	iv)	Operating Temperature (deg. C)		.....	
	v)	Design Temperature (deg. C)		.....	
	vi)	Vent pipe diameter (m)		.....	
	vii)	Vent pipe length (m)		.....	
	viii)	Tank Volume (m3)		.....	
	ix)	Hydraulic test pressure		.....	
	x)	Hammer test pressure		.....	
	xi)	Shell thickness (mm)		.....	
	xii)	Corrosion allowance		.....	
	xiii)	Shell diameter (mm)			
	xiv)	Shell height (mm)			
	xv)	Weight when empty (Kg)			
	xvi)	Material			
		a)	Shell and head		
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CLAUSE NO.	BIDDER'S NAME			एनडीपीसी NTPC	
	b) Nozzle necks c) Nozzle flanges d) Manhole nozzle e) Manhole flange and wearplate f) Supports and structural attachments xvii) List of all drains connected to atmospheric flash tank. xviii) Reference drawing Nos.				
9.06.00	Not used				
9.06.10	Primary, Seal Air and Gas Recirculation fans (if applicable)				
		Primary Air Fan	Seal Air Fan	Gas Recirculation Fan	
	i) Manufacturer ii) Type iii) Nos. of fans / Boiler iv) Mounting v) Arrangement vi) Capacity a) Flow rate at 100% BMCR design firing (M³/sec.) and associated temp. (deg.C) and density (Kg/m³) b) Flow rate at 100% TMCR design firing (M³/sec.) and associated temp. (deg.C) and density (Kg/m³)	 Flow Temp. Density Flow Temp. Density			
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CLAUSE NO.	BIDDER'S NAME		
	c) Flow rate at design point (M³/sec.) and associated temp. (deg.C) and density (Kg/m³) d) Max. flow rate the fan can handle (M³/sec.) and associated temp. (deg.C) and density (Kg/m³) e) Max. flow rate the fan can handle (M³/sec.) and associated temp. (deg.C) and density (Kg/m³)	Flow Temp. Density Flow Temp. Density Flow Temp. Density	
	vii) Static pressure a) Pressure at 100% BMCR design MSW firing (mmwc) b) Pressure at 100% TMCR design MSW firing (mmwc) c) Pressure at design point (mmwc) d) Shut off pressure (mmwc) e) Minimum safe pressure (mmwc)	..... ..... ..... ..... .....	
	viii) Design margin over and above the design Point for test block condition a) Capacity % b) Head%	..... .....	
	ix) Source of air supply		
	x) Normal speed of fan		
	xi) Synchronous speed of motor		
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CLAUSE NO.	BIDDER'S NAME		
	xii) Critical speed a) First critical speed (rpm) b) Second critical speed (rpm) xiii) Design tip speed of blades (M/sec) xiv) Fan efficiency and aux power consumption a) At LP design b) At LP 1 c) At LP 2 d) At LP 3 e) At LP 4 and 5 xvi) Starting torque (Kg/m) xvii) Direction of rotation facing fan coupling (clock wise or anticlockwise) xviii) Impeller diameter (mm) xix) Shaft diameter (mm) xx) Moment of inertia of shaft and impeller xxi) Ovearall dimensions xxii) Size of motor (KW) xxiii) Total weight of fan and motor (tonnes) xxiv) Method of lubrication a) For fans b) For motors xxv) Blades with renewal wearing noses Yes/No		
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CLAUSE NO.	BIDDER'S NAME			
	xxvi)	Mode of air flow control adjustment		
	xxvii)	Material construction		
	a)	Casing	.....	
	b)	Impeller blades	.....	
	c)	Inlet cone	.....	
	d)	Outlet diffuser	.....	
	e)	Impeller hub shroud	.....	
	f)	Shaft	.....	
	g)	Shaft sleeve	.....	
	h)	Coupling	.....	
	i)	Base plate and foundation bolts	.....	
	j)	Inlet vane	.....	
	k)	Renewable wearing nose	.....	
	xxviii)	Bearings		
	a)	Make	.....	
	b)	Number and type	.....	
	c)	Bearing linear material	.....	
	d)	Type of cooling	.....	
	e)	Type of lubrication	.....	
	f)	Grade of lube oil	.....	
	g)	Thermometers provided	Yes/No	
	h)	Thermocouples provided	Yes/No	
	xxix)	Shaft sealing arrangement		
	xxx)	Hydraulic servo drive		
	a)	Nos. make and type		
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CLAUSE NO.	BIDDER'S NAME		
	b) Type of oil seals c) Material of cylinder piston and feed back system d) Number of pumps e) Number, type and material of cooler f) Pressure switches provided Yes/No g) Thermometer provided Yes/No h) Relief valves provided Yes/No xxxi) Lube oil system a) No. of pumps per fan b) No. of pumps standby c) Type of pumps d) No. of oil coolers per fan e) No. of oil coolers standby f) Relief valves provided Yes/No g) Pressure switches provided Yes/No h) Thermometers provided Yes/No i) Electric heater with oil tank Yes/No j) Heater rating (kW) Yes/No xxxii) Whether the following accessories are provided (state Yes/No) a) Coupling guards Yes/No b) Base plate and foundation bolts Yes/No c) Forced lubrication unit with pumps, filters,		
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CLAUSE NO.		BIDDER'S NAME		एन टी पी सी NTPC	
		coolers, connected piping, instrumentation etc.		Yes/No	
	d)	Hydraulic control unit with pumps, filters, coolers, connected piping etc.		Yes/No	
	e)	Local instruments		Yes/No	
	f)	Provision for vibration sensor and monitoring equipment		Yes/No	
	g)	RTD's for fan and motor bearings		Yes/No	
	xxxiii)	Reference drawing Nos.	.....		
	9.06.11	Not used			
	9.07.03	Oil Burners			
	i)	Manufacturer	.....		
	ii)	Type	.....		
	iii)	Design Data	.....		
	a)	Number of oil burners	.....		
	c)	Atomising medium	.....		
	i)	Oil pressure range at burners (kg/cm2)	.....		
	j)	Turned down ratio	.....		
	l)	Combustion air temperature	.....		
	m)	Capacity of each burner (kg/hr & max. heat input per burner (Kcal/kg)			
	v)	Material of construction			
	a)	Oil burner mixing plate/ spray plate			
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
9.07.04	b)	Guard pipe			
	c)	Diffuser			
	d)	Concentric tubes			
	e)	Clamp	.....		
	f)	Gaskets	.....		
	g)	Flexible tubing	.....		
	h)	Burner body	.....		
	i)	Burner tip	.....		
	vi)	Whether the following accessories are provided			
	a)	Limit switches	Yes/No		
	b)	Clamps	Yes/No		
	c)	Gaskets	Yes/No		
	d)	Flexible hose	Yes/No		
	e)	Insertion/retract facility	Yes/No		
	f)	Steam/air cooling	Yes/No		
	g)	Position indications	Yes/No		
	vii)	Codes and standards applicable	.....		
viii)	Reference Drawing Nos.	.....			
9.08.00	Fuel oil igniters				
	i)	Manufacturer	.....		
	ii)	Type	.....		
	iii)	Number of ignitor	.....		
	iv)	Retractable or stationary	.....		
	v)	Reference drawing Nos.	.....		
9.08.00		Fan Design Data			
		(These data shall be furnished for the LP 1 to LP 5 points and design point)			
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CLAUSE NO.	BIDDER'S NAME 
9.08.01	F.D. Fans i) Pressure drop summary (MMWC) a) Wind box b) Hor air duct c) Air heater d) SCAPH e) Air flow device f) Cold air duct g) Silencer h) Total ii) Volume handled by fan a) Air leaving APH b) APH leakage (M³/sec) c) Air temperature (deg C) d) Volume handled per fan as calculated (M³/sec) e) Volume handled per fan as designed (M³/sec) iii) Parameters of fan a) Volume (M³/sec) b) Head (mmwc) c) Air inlet temperature (deg C) d) Density of air (kg/m³)

CLAUSE NO.	BIDDER'S NAME										
9.08.02	e)	Fan inlet pressure (mmwc)									
	iv)	Fan shaft power (kw)									
	P.A. Fans										
	i)	Pressure drop summary (MMWC)									
	a)	Fuel Piping									
	b)	Pulveriser									
	c)	Hot air duct									
	d)	Air heater									
	e)	Venturi									
	f)	Cold air duct									
	g)	Silencer									
	h)	SCAPH									
	i)	Control dampers									
	j)	Total									
	ii)	Volume handled by fan									
	a)	Air leaving APH (M3/sec)									
	b)	APH leakage (M³/sec)									
	c)	Temperaturing Air (M³/sec)									
	d)	Air through each fan (M³/sec)									
	e)	Air inlet temperature (deg. C)									
f)	Volume of air handled by each fan (M³/sec)										
iii)	Paramters of fan										
a)	Volume (M3/sec)										
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CLAUSE NO.	BIDDER'S NAME 
9.08.03	b) Head (mmwc) c) Air inlet temperature (deg C) d) Density of air (kg/m³) e) Fan inlet pressure (mmwc) iv) Fan shaft power (kw) I.D. Fans i) Constant pressure drops : (MMWC) a) Furnace b) Static head c) Others (mention) d) Total ii) Variable pressure drops (mmwc) a) SH/RH/Economiser b) Air heater c) Ducts and dampers d) Electrostatic Precipitator e) Total iii) Volume handled by fan a) Gas entering APH (M3/sec) b) Air heater leakage (M3/sec) c) Gas flow rate at fan inlet d) Gas volumetric flow fan inlet (deg. C)

CLAUSE NO.	BIDDER'S NAME एनडीपीसी NTPC
9.09.00	e) Gas volumetric flow as designed (M3/sec) f) Gas volumetric flow as designed (M3/sec) iv) Fan parameters a) Volume (M3/sec) b) Head (mmwc) c) Gas temperature at I.D. inlet (deg C) d) Density (kg/m3) v) Fan shaft power (kw) Gas Recirculation Fan i) Pressure drop (mmwc) ii) Volume handled by fan iii) Fan parameters a) Volume (M³/sec.) b) Head (mmwc) c) Gas temperature at I.D. inlet (deg.C) d) Density (kg/m³)
9.10.00	Ducting design data
9.11.00	GENERAL
9.11.01	i) Material specification a) Air ducts b) Gas ducts ii) Plate thickness (mm) a) Air ducts b) Gas ducts
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.: CS-2600-001-9 PART-G CHAPTER-II SUB-SECTION:DM1 (MECHANICAL- STEAM GENERATOR) PAGE 26 OF 30

CLAUSE NO.	BIDDER'S NAME						एनडीपीसी NTPC	
9.11.02	iii)	Stiffners spacing (mm)						
	a)	Air ducts	.....	.....	.....	.....	.....	
	b)	Gas ducts	.....	.....	.....	.....	.....	
	iv)	Duct design Pressure (mmwc)						
	a)	Air ducts	.....	.....	.....	.....	.....	
	b)	GAs ducts	.....	.....	.....	.....	.....	
	v)	Maximum operating pressure (mmwc)						
	a)	Air ducts	.....	.....	.....	.....	.....	
	b)	Gas ducts	.....	.....	.....	.....	.....	
	vi)	Design code used for duct design	A copy of code to be enclosed					
		Air ducting design data (Sized in accordance with criteria specified in clause 1.05.14, sub-section-A 02, Part B, Section VI.)	Cross Sect- tion (M2)	Length (M)	Weight (Kg)	Max. pres- sure (mmwc)	Max. flow (m3/ sec)	Max. Velocity (m/sec)
	i)	F.D. Fan to APH						
	ii)	APH to wind box						
	iii)	Hot side inter connecting duct (secondary)						
	iv)	Cold side interconnecting duct (secondary)						
v)	P.A. fan to APH	.....	.....	.....	.....	.....	.....	
vi)	Hot primary air duct to mills (before tempering)	.....	.....	.....	.....	.....	.....	
vii)	Cold primary air duct before tempering							
viii)	Hot primary air to mills (after tempering)							
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CLAUSE NO.		BIDDER'S NAME					एनडीपीसी NTPC	
9.11.03		Gas ducting design data (Sized in accordance with criteria specified in clause 1.05.14, sub-section-A 02, Part B, Section VI.)						
		i)	APH outlet to Bag filter	.....	.....	.....	.....	.....
		a)	Primary side	.....	.....	.....	.....	.....
		b)	Secondary side	.....	.....	.....	.....	.....
		ii)	Bag filter to I.D. fan inlet	.....	.....	.....	.....	.....
		iii)	I.D. fan outlet to chimney flue inlet	.....	.....	.....	.....	.....
9.11.04		Following documents to be submitted for chimney inlet transition ducting						
		a)	detailed arrangement drawings				Yes/No	
		b)	calculation for determining friction losses				Yes/No	
9.12.00		THERMAL INSULATION						
9.12.01		Insulating material						
		i)	Type of insulating material (s)	.....	.....	.....	.....	.....
		ii)	Manufacturer's name	.....	.....	.....	.....	.....
		iii)	Maximum hot face temp. (deg. C) the insulating material can withstand	.....	.....	.....	.....	.....
		iv)	Bulk Density of insulating material (Kg./m ³)	.....	.....	.....	.....	.....
		v)	Thermal conductivity (Kcal/hr.m. deg C) at mean temperature of					
		a)	50 deg C					
		b)	100 deg. C					
		c)	150 deg C					
		d)	200 deg C					
		e)	250 deg C					
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CLAUSE NO.	BIDDER'S NAME							एनडीपीसी NTPC	
9.12.02	f)	300 deg C							
	vi)	Resistance to micro organism (Yes/No)							
	vii)	Incombustibility (Yes/No)	.....	.....	.....	.....	.....		
	Steam Generating Plant & Auxiliaries Insulation & casing		Block		Segmented Cement Blocked	Flat	Outer	Outer	
			Resin Bonded Mineral Wool	pour-able insulation	calcium silicate	lagg-ing	Alum iniumcasing ribbed	Sheet (specify details)	
			(mm/Qty)	(mm/Qty)	(mm/Qty)	(mm/Qty)	(mm/Qty)	mm/Qty)	
	i)	Furnace Extended side backpass walls							
	ii)	Enclosure							
	a)	Roof							
		- Horizontal							
	- Vertical								
b)	Extended side								
	- Horizontal								
	- Vertical								
c)	Bottom								
	- Horizontal								
	- Vertical								
iii)	Duct Work								
a)	Economiser to air heater								
b)	Air heater to electro-static precipitator								
c)	Electrostatic precipitator to ID fan & stack								
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	d)Hot air after air pre-heater to wind box and mills iv)Equipment a)Air heaters b)ID fans v)Pressure parts a)Drum & headers b)Water wall platens c)Water wall platen supply tubes d)SH header e)Economiser outlet f)Soot blower piping g)Spray water & misc. piping h)Boiler Startup Recirculation pumps and associated piping vi)Any other (Give details)			
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CLAUSE NO.	BIDDER'S NAME		
10.00.00	ELEVATORS	Goods Elevator	Passenger Elevator
10.01.00	Technical Information		
	i) Detailed description of equipments	.....	
	ii) Write up on interlocks and safety devices provided	.....	
	iii) Schedule of motors	.....	
	iv) General arrangement of elevators	.....	
	v) Electrical control scheme	.....	
	vi) Foundation details and loading	.....	
10.02.00	Design Data		
	i) Manufacturer	.....	
	ii) Capacity (kg)	.....	
	iii) Speed (M/sec)	.....	
	iv) Acceleration & deceleration (m/sec ²)	.....	
	v) Method of control	.....	
	vi) Mode of operation	.....	
	vii) Car finish	.....	
	viii) Location of machine room	.....	
	ix) Levelling limits of car from landing floor (mm)		
	x) Elevator Car		
	a) Travel (mm)		
	b) Entrance size (mm x mm)		
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CLAUSE NO.	 BIDDER'S NAME		
	c) Platform length (mm) d) Platform width (mm) xi) Elevator Pit a) Depth (mm) b) Inside length (mm) c) Inside width (mm) d) Entrance height (mm) e) Entrance width (mm) xii) Hoist way a) Height (M) b) Inside length (mm) c) Inside width (mm) d) Entrance height (mm) e) Entrance width (mm) xiii) Machine room a) Total clearance height (M) b) Room height (M) c) Height from top floor to underside of supporting member (M) xiv) Total weight of elevator with elevator shaft structures (tonnes) xv) Total weight of elevator structures (tonnes) xvi) Electric Brake a) Manufacturer b) Type c) Operating coil (A.C.		
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CLAUSE NO.	BIDDER'S NAME		
11.00.00		or DC)	
	d)	Size	
	e)	Brake drum diameter (mm)	
	f)	Brake drum face width (mm)	
	g)	Brake drum & liner material	.....
	xvii)Traction Sheave		
	a)	Diameter (mm)	.....
	b)	Material	.....
	xviii) Ropes		
	a)	Diameter (mm)	.....
	b)	Wire material	.....
	c)	Construction	.....
	d)	Core material	.....
	e)	Guaranteed minimum breaking strength of rope (kg/cm ²)	.....
	xix) Emergency battery and charger ratings		
	EQUIPMENT DIMENSIONS AND WEIGHTS		
		Dimensions	Weight (Tonnes)
	i)	Supporting structure	.....
	ii)	Galleries and stairways	.....
	iii)	Interconnecting platforms	
iv)	Steam Drum/header		
v)	Manholes/inspection		
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CLAUSE NO.	BIDDER'S NAME		
	windows etc.		
	vi) Water walls		
	vii) Super heater		
	viii) Hanger		
	ix) Desuperheater	.....	.....
	x) Economiser including heat exchanger	.....	.....
	xi) Valves & fittings	.....	.....
	xii) a) - Air preheaters	.....	.....
	- Primary	.....	.....
	- Secondary	.....	.....
	b) Steam coil air preheater	.....	.....
	- Primary	.....	.....
	- Secondary	.....	.....
	xiii) Fabricated components for main steam generator under sheet casing	.....	.....
	xiv) Covering & insulation material for steam generator and other equipment	.....	.....
	xv) Steam generator	.....	.....
	xvi) Fabricated components for insulation of steam generator equipment	.....	.....
	xvii)Skin casing		
	xviii) Internal gas lines		
	xix) Fuel oil preheating unit(not applicable)		
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CLAUSE NO.	BIDDER'S NAME		
12.00.00	xxi) Fuel gas burners		
	xxii) Igniter/scanner air system		
	xxvi) Hot air ducts	.....	.....
	xxvii) Fuel ducts	.....	.....
	xxviii) Other ducting	.....	.....
	xxix) Soot blowers	.....	.....
	xxx) Soot blowing equipment	.....	.....
	xxxv) FD fans with drives	.....	.....
	xxxvi) ID fans with drives	.....	.....
	xxxvii) PA fans with drives	.....	.....
	xxxviii) Other fan with drives	.....	.....
	xxxxi) Fan duct	.....	.....
	xxxxii) Platforms and rails	.....	.....
	xxxxiii) Supporting structure for flue gas system	.....	.....
	xxxxiv) Dampers/vanes	.....	.....
	xxxxv) Fabricated components for insulation of flue gas system	.....	.....
	xxxxvi) Others	.....	.....
	xxxxvii) Total weight	.....	.....
	Technical information with respect to geometrically similar MSW fired Grate & steam generator manufactured and installed by the bidder which are in successful operation.		
	1. Name of station		
2) MSW throughput			
3) Steam Generator Rating			
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CLAUSE NO.	 BIDDER'S NAME		
	i) Superheater outlet steam flow (tph) ii) Superheater outlet steam pressure (Kg/cm²) (abs) iii) Superheater outlet temperature (°C) viii) Feed water temperature (°C) at ECO inlet ix) Steam generator efficiency-Design/tested x) Heat liberated by fuel per unit furnace volume (Kcal/m³/hr) xi) Furnace cooling factor (Kcal/m³/hr) xii) Grate heat release rate (Kcal/m²/hr) xiii) Plan area heat release rate (Kcal/m²/hr) 4) MSW characteristics (Enclose in similar format as in Tech. spec). 5) Total no. of Grate line 8) Furnace exit gas temperature 9) Excess air to ECO outlet (%) 10) SH spray flow - design - tested 13) Operational problems found if any, with respect to spray slagging fouling, tube failures etc.		
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CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
		14) Modifications carried out if any, write details & reasons			
		15) Start up time achieved (minutes)	.....		
		- Cold	.....		
		- Warm	.....		
		- Hot	.....		
		16) Furnace sketch including dimension, arrangement and pressure parts disposition etc.	.....		
13.00.00		Special Tools Tackles:			
		One complete set of all special tools & tackles for maintenance for each Steam Generator as identified in Clause 2.24.00 of Sub-Section-II A01, section VI-part A		Yes/No	
		Bidder to furnish the list in detail and it should necessarily include the following:			
13.01.00		Special tools & tackls for each mill as required for erection,testing, maintenance of equipment system including those required for inst.& control (Refer Clause 2.24.01(a) of sectionVI Part-A, Sub-Section- II A01)			
13.02.00		Set of Maintenance tools: (Refer clause 2.24.01(b)1 & 2 of sectionVI Part-A, Sub-Section- II A01)			
		(1) General Maintenance Tools		Yes/No	
		(i) Pulling cable, eyebolts, cable slings, chaining falls, snubbing lines or cables.		Yes/No	
		(ii) Bar and sledge hammers		Yes/No	
		(iii) Brass and lead hammers		Yes/No	
		(iv) Power type jacks and jacking screws		Yes/No	
		(v) Feeler gauges and shims		Yes/No	
		(vi) Dial indicators		Yes/No	
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CLAUSE NO.	BIDDER'S NAME			
	(vii)	Wire brushes & scrappers	Yes/No	
	(viii)	Bearing and coupling pullers	Yes/No	
	(ix)	Spanners and wrenches of various sizes	Yes/No	
	(2) Special Maintenance Tools			
	(i)	Tube expanders for heat exchangers	Yes/No	
	(ii)	Lapping plates, grinding stones and ring cap for the valves	Yes/No	
	(iv)	Spanners and wrenches specific to the equipment	Yes/No	
	(v)	One intrascope suitable for inspection of all Steam Generator pressure parts.	Yes/No	
	(vi)	Four (4) nos. of pneumatic emergency soot blower retract drives per boiler with matching crank tools suitable for retracting each type of soot blower being provided along with connecting pipe, fittings etc	Yes/No	
		1.Quantity	.....	
		2.Type & Make	.....	
		3.Technical details	.....	
13.03.00	Power operated gondola(s)/furnace maintenance cradle/cradles (Refer clause 2.24.02 of sectionVI Part-A, Sub-Section- II A01)			
	1.	No. of Sets	ONE.....	
	2.	Type & make	.....	
	3.	Major Parameters	.....	
13.04.00	Quick erect scaffolding conforming to Tech. Spec. (Refer clause 2.24.04 of sectionVI Part-A, Sub-Section- II A01)		Yes/No	
	1.	No. of Sets		
	2.	Type & make		
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CLAUSE NO.	BIDDER'S NAME			एनटीपीसी NTPC
	3. Material of Construction			
	4. No. of mandays required for erection Considering work force deployed for 24 hrs. in 3 shifts a day			
	5. Locking Arrangement	Yes/No		
	6. Other Details	.....		
13.05.00	Instrument for Tube Thickness Measurement conforming to Tech. Spec. (Refer Clause 2.24.06 of section VI Part-A, Sub-Section- II A01)	Yes/No		
	1. Quantity	.....		
	2. Type & Make	.....		
	3. Technical details	.....		
14.00.00	MAX.INDIVIDUAL FLOWS(T/HR.) AND PARAMETERS OF MAIN STEAM, AND AUXILIARY STEAM PIPELINE DRAINS TO BE SUPPLIED TO FLASH TANKS IN TG SCOPE:			
	1. Main Steam drains			
	2. Aux. Steam drains			
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CLAUSE NO.	BIDDER'S NAME			
	SUB SECTION – DM2			
	TECHNICAL INFORMATION / DATA TO BE SUBMITTED ALONGWITH THE BID			
1.00.00	GENERAL TECHNICAL INFORMATION / DATA			
	DRAWINGS FOR BAG FILTER			
1.01.00	Performance Data for BAG FILTER			
	i)	Characteristic/Correction Curves	.....	
	a)	Gas flow rate vs efficiency	.....	
	b)	Gas temperature vs efficiency	.....	
	c)	Inlet dust concentration vs efficiency	.....	
	d)	Combined effect of gas temperature and dust concentration vs efficiency	.....	
	h)	Gas flow rate vs pressure drop across BAG FILTER	.....	
	i)	Efficiency vs varying value of moisture in flue gas	.....	
1.02.00	Supplementary Data for BAG FILTER			
	i)	A complete list of all the equipment requiring the following shall be furnished indicating parameters continuous requirements and the maximum requirement together with schematic diagrams		
	a)	Cooling water	.....	
	b)	Service air	.....	
	c)	Instrument air	.....	
	ii)	Schedule of power consumption	.....	
	iii)	Complete schedule of motors giving voltage, phase, KW rating (calculated and installed capacity). service factor etc.		
	iv)	Recommended mode of erection sequence and other relevant		
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CLAUSE NO.	BIDDER'S NAME			
	particulars in Bag Filter of installation of :			
	a) Structural Steel			
	b) Rotating Equipment	.....		
	c) Static Equipment	.....		
	d) Others	.....		
	v) Detailed recommended procedures for welding and erection	.....		
	vi) A comparison and history of all electrostatic precipitators in service of similar design and size to that proposed including descriptions of operating difficulties.	.....		
	vii) A complete list of local instruments, sensing devices and control equipment covered in the proposal with type, make, accuracy, range, details, dial size etc. in the Bidder's scope.	.....		
	viii) List of special maintenance tools included in the proposal	.....		
	ix) List of insert panels, control cabinets and local control panels included in the proposal with GA drawings, mounting and output details	.....		
	x) List of field mounted junction boxes included in the proposal.	.....		
	xi) List and details of instruments & control items supplied loose for mounting on control panels, including details like type. make, cutout & drawings etc.	.....		
	xii) Temperature sensors calibration standards	.....		
	xiii) List of annunciations giving suggested set values of parameters			
	xiv) List of inputs provided for Data Acquisition System			
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CLAUSE NO.	BIDDER'S NAME			
1.03.00	xv)	Particulars of prefabricated & other special cables included in Bidder's scope		
	xvi)	Write up on BAG FILTER internals including bag filter, bag holder,	.....	
	xviii)	Write up on interlocks and protections	.....	
	xix)	Write up on type hopper dust level indicators	.....	
	xx)	Detailed hopper sizing calculation	.....	
	xxi)	Write up on dedusting mechanism	.....	
	xxiii)	Detailed calculations for working out of BAG FILTER inlet gas flow, gas temperature, inlet dust burden and BAG FILTER efficiency.	.....	
	xxiv)	Heat loss calculation from the hopper and hopper heater sizing calculations	.....	
	xxv)	Details of PC, keyboards, printer etc. for BAG FILTER management system	.....	
	xxvi)	Details of manufacturing and erection tolerances for BAG FILTER internals.	.....	
	Drawings			
	i)	General arrangement drawing (Plan and elevation) with appropriate dimensions	.....	
	ii)	Layout of BAG FILTER structural steel columns. These shall indicate the size of members and main dimensions, with design loadings and all lifting facilitate for purposes of maintenance.	.....	
	iii)	Arrangement of platforms, walkways and galleries	.....	
iv)	Schematic diagram indicating terminal points and instrumentation & controls included in Bidder's scope and suggestive scheme for flue gas system indicating, pipe duct size (OD's and ID's) operating parameters, maximum fluid			
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CLAUSE NO.	BIDDER'S NAME			
	velocities, insulation thickness and material specification etc. v) Location plan - Details of location and arrangement scheme of columns embedments and fixing details, size of pedestals, levels blockouts & anchor bolts. and channels indicating scope of supply by equipment supplier vi) Loading on foundations : Axial load, bending moments and shear forces transmitted to foundations of following loading combinations separately. a) Dead load b) Live load c) Wind load d) Seismic load vii) Complete bracing arrangements for BAG FILTER supporting structures and combinations of (+v) and (-v) forces for the seismic or wind (which ever is governing) viii) Percentage of live load considered for calculating wind and seismic forces ix) Recommended size and general arrangement of BAG FILTER control room in plan and sections along with its location plan. x) Schedule of heat load for air conditioning xi) Gas distribution system (if applicable) xv) Hopper details clearly indicating location of level mentions electrical heaters, pake holes, baffles, etc. xvii) Weather proof enclosure and lifting beam arrangement xviii) Schematic diagram controls and diagrams			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART G BID DOC. NO.: CS-2600-001-9	CHAPTER-II SUB-SECTION:DM2 (MECHANICAL-BAG FILTER)	PAGE 4 OF 11

CLAUSE NO.	BIDDER'S NAME			
1.04.00	EQUIPMENT DATA			
1.04.01	General			
	i)	Manufacturer	.....	
	ii)	Manufacturer's model number	.....	
	a)	Width (across gas flow) (m)	.....	
	b)	Flange to Flange length (in direction of gas flow) (m)	.....	
	c)	Height between bottom of hoppers to support level (m)	.....	
	d)	Height between support level to top of monorail steel (m)	.....	
	e)	Height between top insulator compartments to top of monorail steel (m)	.....	
	iv)	Number of Bags	.....	
	v)	Number of pass per boiler	.....	
	vi)	Number of gas streams per boiler	.....	
	x)	Power consumption per set of Bag filter'	.....	
	xii)	Guaranteed collection efficiency (%)	.....	
	xiv)	Guaranteed pressure drop across Bag filter of one steam Generator (mm wc)	.....	
	xv)	Guaranteed air in leakage rate (M ³ /sec)	.....	
	xvii)	Total active collection area (M ²)	.....	
	xix)	Gas velocity through Bag filter (M/sec)	.....	
	xx)	Aspect ratio		
	xxii)	Proposed standard for conducting the performance tests		
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CLAUSE NO.	BIDDER'S NAME			
1.04.05	Bag filter casing i) Material ii) Plate thickness iii) Design pressure (mm wg) iv) Design temperature (deg C) v) Max. temperature with stand capacity and duration vi) Number of inspection doors vii) Dimensions of access openings of inspection doors (mmx mm)			
1.08.00	Dust Hoppers i) No. per field gas stream ii) No per BAG FILTER of one boiler iii) Material iv) Plate thickness (mm) v) Side angle (degrees) vi) Valley angle (degrees) vii) Storage capacity of each hopper (hours) viii) Volumetric storage capacity of each hopper (m ³) ix) No. and height of gas screens per hopper x) No. of access doors per hopper xi) Access door dimensions (mm x mm) xii) Height of the hopper bottom flange above the ground level (metres) xiii) Size of hopper outlet flanges (mm)			
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CLAUSE NO.	BIDDER'S NAME			
1.18.00 1.18.01	xiv) Hopper heating			
	a) Control temperature (deg C)			
	b) Hopper heating power per hopper (KW)			.....
	c) Hopper heating power per m ² (KW)			.....
	xv) Hopper heater data			.....
	a) Name of the manufacturer			.....
	b) No. of modules per hopper			.....
	c) Voltage level			.....
	d) Maximum watt density (W/SQM)			.....
	e) Total heating load per heater			.....
	f) Estimated life of heating module			.....
	g) No. of heater element multiple paths in each module			.....
	h) Maximum exposure temp rating of module			.....
	i) Moisture resistance			.....
	i) Prior to operation			.....
	ii) After 2 years of operation			.....
	xvi) Hopper dust level detectors			.....
	a) Number per hopper			.....
	b) Type			.....
	xvii) Ash collection rate (Kg/hr)		at different operating load points	
	a) First row			.....
b) Second row			.....	
	For all the rows (as applicable)			
	DUST EMISSION MONITOR			
	Manufacturer's name			
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CLAUSE NO.	BIDDER'S NAME एनटीपीसी NTPC
	(Shall be as per approved QA make) 1.18.02 Model Name Number 1.18.03 Type 1.18.04 Quantity / Boiler 1.18.05 Range 1.18.06 Calibrated accuracy 1.18.07 Power supply 1.18.08 Automatic Zero/Span adjustment with manual override provided Yes/No 1.18.09 All accessories required for completeness of the system as per specification Yes/No 1.18.10 Automatic compensation for variation in line voltage, detector sensitivity, lamp ageing, ambient illumination provided Yes/No 1.18.11 Automatic shutter operation during purge air/power supply failure is provided Yes/No 1.18.12 Alignment indicator providedYes/No..... 1.18.13 Converter a) Opacity indicator with selection of measurement ranges provided Yes/No b) Output signal and number of outputs c) Remote calibration control provided Yes/No d) Status indication providedYes/No..... e) Number of alarms f) Provision for alarm with adjustable time delay Yes/No 1.18.14 Equipment cabinet size (WXHXD in mm) 1.18.15 Equipment Cabinet protection class (IP) 1.18.16 Performance
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI PART G BID DOC. NO.: CS-2600-001-9 CHAPTER-II SUB-SECTION:DM2 (MECHANICAL-BAG FILTER) PAGE 8 OF 11

CLAUSE NO.		BIDDER'S NAME		एनटीपीसी NTPC	
		a) Mean interval between maintenance	.....		
		b) Auto Calibration interval	.....		
		c) Calibration drift in 24 hrs	.....		
		d) Zero drift in 24 hrs	.....		
		e) Calibration error within	.....		
		f) Maximum continuous operating temperature	.....		
		g) Maximum temperature withstand capability / duration	.....		
1.18.17	Technical literature furnished at	Page No.	Sec No.		
1.18.18	Recommended installation drawing furnished at	Page No.	Sec. No.		
1.20.00	INSULATION AND CLADDING				
	i) Area to be insulated per four gas streams of precipitators (m²)	.....			
	a) Casing	.....			
	b) Hoppers	.....			
	c) Roof	.....			
	d) Nozzles	.....			
	e) Any other	.....			
	f) Total	.....			
	ii) Material	.....			
	iii) Insulating material standard	.....			
	iv) Thickness (mm)	.....			
	v) Density (Kg/M³)	.....			
	vi) Thermal conductivity (Kcal/m/hr/deg.C) at mean temperature of	.....			
KAWAS WTE PROJECT (2 X 350 TPD) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART G BID DOC. NO.: CS-2600-001-9		CHAPTER-II SUB-SECTION:DM2 (MECHANICAL-BAG FILTER)	
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CLAUSE NO.	एनटीपीसी NTPC BIDDER'S NAME
1.21.00	a) 50 deg C b) 100 deg C c) 150 deg C d) 200 deg C e) 250 deg C f) 300 deg C g) 350 deg C h) 400 deg C vii) Resistive to micro organism (Yes/No) viii) Incombustibility (Yes/No) ix) Material of skin casing x) Thickness of skin casing EQUIPMENT WEIGHT (TOTAL) i) Structural Steel ii) Casing including gas distribution system iii) Hoppers (empty) iv) Hoppers (full) x) Platforms, Walkways stairways xiii) Control and Instrumentation xiv) Others xv) Total estimated weight (Per boiler) a) Excluding dust b) Including dust

CLAUSE NO.	BIDDER'S NAME			
1.22.00	DATA FOR REFERENCE PLANTS (USE ONE SEPARATE SHEET FOR EACH REFERENCE PLANT)			
1.22.01	WtE Plant details	.....		
	a) Unit rating (MW)	.....		
	b) Commissioning Date	.....		
1.22.02	Precipitator Design			
	i) Design flue gas flow (m3/sec)	.....		
	ii) Design flue gas temperature (deg C)	.....		
	iii) No. of BAG FILTERs per boiler	.....		
	iv) No. of gas stream per boiler	.....		
	v) Total collecting plate area (m²)	.....		
	vi) Gas velocity at design flow	.....		
	xvi) Aspect ratio	.....		
	xvii) Installed power (KW)	.....		
	1.22.03	Design fuel		
i) Ash Content (%)		.....		
ii) Moisture Content (%)		.....		
iii) Gross Calorific value (Kcal. Kg)		.....		
iv) Sulphur content (%)		.....		
1.22.04	Efficiency			
	i) Guaranteed efficiency (%)			
	ii) Acceptance test efficiency (%)			
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CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			एनडीपीसी NTPC
1.00.00	Continuous Water Requirement for WTE plant to be filled by bidder in below mentioned format			
	System	Water Quality(DM/Raw/Clarified)	Water Quantity(cum/hr)	
	1.Power Cycle Make Up			
	2.Auxiliary Cooling water make-up			
	3.HVAC make-up water			
	4.FGD Process water			
	5.SNCR consumptive water			
	6.Service water			
	7. Potable water			
	8. Water for quenching ash			
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