

# *NTPC Limited*

(A Government of India Enterprise)



## **LOT-IB PROJECTS**

**PART - C**

## **GENERAL TECHNICAL REQUIREMENTS**

**SECTION – VI**

**FOR**

## **FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**BIDDING DOCUMENT NO.: CS-0011-109(1B)-9**

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## PART - C

# **GENERAL TECHNICAL REQUIREMENTS**

<p>LOT-IB PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC NO: CS-0011-109(1B)-9</p>
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## GENERAL TECHNICAL REQUIREMENTS

### PART - C

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1.00.00	<p><b>INTRODUCTION</b></p> <p>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.</p>	
2.00.00	<p><b>BRAND NAME</b></p> <p>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.</p>	
3.00.00	<p><b>BASE OFFER &amp; ALTERNATE PROPOSALS</b></p> <p>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.</p>	
4.00.00	<p><b>COMPLETENESS OF FACILITIES</b></p>	
4.01.00	<p>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.</p>	
4.02.00	<p>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.</p> <p>All same standard components/ parts of same equipment provided, shall be interchangeable with one another.</p>	

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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	<b>RULES, REGULATIONS, CODES &amp; STANDARDS</b>	
5.01.00	<p>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:</p> <ul style="list-style-type: none"> <li>a) Indian Electricity Act</li> <li>b) Indian Electricity Rules</li> <li>c) Indian Explosives Act</li> <li>d) Indian Factories Act and State Factories Act</li> <li>e) Indian Boiler Regulations (IBR)</li> <li>f) Regulations of the Central Pollution Control Board, India</li> <li>g) Regulations of the Ministry of Environment &amp; Forest (MoEF), Government of India</li> <li>h) Pollution Control Regulations of Department of Environment, Government of India</li> <li>i) State Pollution Control Board.</li> <li>(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).</li> <li>(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996</li> <li>(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998</li> <li>(m.) Explosive Rules, 1983</li> <li>(n.) Petroleum Act, 1984</li> <li>(o.) Petroleum Rules, 1976,</li> </ul>	

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5.02.00	<p>(p.) Gas Cylinder Rules, 1981</p> <p>(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981</p> <p>(r.) Workmen's Compensation Act, 1923</p> <p>(s.) Workmen's Compensation Rules, 1924</p> <p>(t.) NTPC Safety Rules for Construction and Erection</p> <p>(u.) NTPC Safety Policy</p> <p>(v.) Any other statutory codes / standards / regulations, as may be applicable.</p> <p>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:</p> <p>a) Bureau of Indian standards (BIS)</p> <p>b) Japanese Industrial Standards (JIS)</p> <p>c) American National Standards Institute (ANSI)</p> <p>d) American Society of Testing and Materials (ASTM)</p> <p>e) American Society of Mechanical Engineers (ASME)</p> <p>f) American Petroleum Institute (API)</p> <p>g) Standards of the Hydraulic Institute, U.S.A.</p> <p>h) International Organisation for Standardisation (ISO)</p> <p>i) Tubular Exchanger Manufacturer's Association (TEMA)</p> <p>j) American Welding Society (AWS)</p> <p>k) National Electrical Manufacturers Association (NEMA)</p> <p>l) National Fire Protection Association (NFPA)</p> <p>m) International Electro-Technical Commission (IEC)/European Norm (EN)</p> <p>n) Expansion Joint Manufacturers Association (EJMA)</p> <p>o) Heat Exchange Institute (HEI)</p>	

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	<p>p) IEEE standard</p> <p>q) JEC standard</p>	
5.03.00	<p>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.</p>	
5.04.00	Not used.	
5.05.00	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.	
5.06.00	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.	
5.07.00	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.	
5.08.00	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.	
6.00.00	<b>EQUIPMENT FUNCTIONAL GUARANTEE</b>	
6.01.00	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.	
6.02.00	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	<b>DESIGN OF FACILITIES/ MAINTENANCE &amp; AVAILABILITY CONSIDERATIONS</b>	
7.01.00	<p><b>DESIGN OF FACILITIES</b></p> <p>All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.</p> <p>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.</p>	
7.02.00	<p><b>MAINTENANCE AND AVAILABILITY CONSIDERATIONS</b></p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	
8.00.00	<b>DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR</b>	
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 specification. All engineering and technical services required to ensure a completely	
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	<p>engineered plant shall be provided in respect of mechanical, electrical, control &amp; instrumentation, civil &amp; structural works as per the scope.</p> <p>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.</p> <p>The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.</p> <p>A comprehensive engg and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.</p>	
8.02.00	The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in <b>Annexure-VI</b> 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	<p><b>A) BASIC ENGINEERING DOCUMENTATION</b></p> <p>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:</p> <ul style="list-style-type: none"> <li>i) System description of all the mechanical, electrical, control &amp; instrumentation &amp; civil systems.</li> <li>ii) Technology scan for each system / sub-system &amp; equipment.</li> <li>iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.</li> <li>iv) Optimisation studies including thermal cycle optimisation.</li> <li>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.</li> <li>vi) Schemes and Process &amp; Instrumentation diagrams for the various systems/ sub-system with functional write-ups.</li> </ul>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	નાનીયિકી NTPC
	<p>vii) Operation Philosophy and the control philosophy of the equipments/system covered under the scope.</p> <p>ix) General Layout plan of the FGD System 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.</p> <p>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.</p> <p>xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.</p> <p>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 &amp; finalised with the Employer.</p>	
<p><b>B) DETAILED ENGINEERING DOCUMENTS</b></p> <p>i) General layout plan of the FGD System.</p> <p>ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.</p> <p>iii) Flow diagram, process and instrumentation diagrams along with write up and system description.</p> <p>iv) Performance curves for Absorber</p> <p>v) Piping isometric, composite layout and fabrication drawings.</p> <p>vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.</p> <p>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.</p> <p>viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like mills, fans etc. as per criteria specified elsewhere in specification.</p> <p>ix) Absorber sizing calculations. Absorber performance data.</p>		

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	<ul style="list-style-type: none"> <li>x) Mass Balance Diagram</li> <li>xi) Characteristic Curves/ Performance Correction Curves.</li> <li>xii) Comprehensive list of all terminal points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled &amp; end connection details, forces, moments etc.</li> <li>xiii) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.</li> <li>xiv) Protection system diagrams and relay settings.</li> <li>xv) Cables schedules and interconnection diagrams.</li> <li>xvii) Cable routing plan.</li> <li>xviii) Instrument schedule, measuring point list, I/O list, Interconnection &amp; 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.</li> <li>xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms &amp; trip set points.</li> <li>xx) Sequence and protection interlock schemes.</li> <li>xxi) Type test reports, insulation co-ordination study report</li> <li>xxii) Control system configuration diagrams and card circuit diagrams and maintenance details.</li> <li>xxiii) Detailed Control system manuals.</li> <li>xxiv) Detailed flow chart for digital control system.</li> <li>xv) Mimic diagram layout, Assignment for other application engg.drawings and documents.</li> <li>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</li> </ul>	

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8.03.02	<p>scope of the bidder civil calculation sheets including structural analysis and design alongwith output results.</p> <p>xxvii) Underground facilities, levelling, sanitary, land scaping drawings.</p> <p>xxviii) Geotechnical investigation and site survey reports (if and as applicable).</p> <p>xxix) Model study reports wherever applicable.</p> <p>xxx) Functional &amp; guarantee test procedures and test reports.</p> <p>xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.</p> <p>xxxii) Maintenance schedule for Absorber &amp; auxiliaries clearly indicating interval, duration if shutdown required, manhours required and tools &amp; tackles required for maintenance.</p> <p>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.</p> <p><b>INSTRUCTION MANUALS</b></p> <p>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 <b>Annexure-IV</b>. 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.</p> <p><b>A) ERECTION MANUALS</b></p> <p>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.</p> <p>a) Erection strategy.</p> <p>b) Sequence of erection.</p>	

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	<p>c) Erection instructions.</p> <p>d) Critical checks and permissible deviation/tolerances.</p> <p>e) List of tool, tackles, heavy equipments like cranes, dozers, etc.</p> <p>f) Bill of Materials</p> <p>g) Procedure for erection and General Safety procedures to be followed during erection/installation.</p> <p>h) Procedure for initial checking after erection.</p> <p>i) Procedure for testing and acceptance norms.</p> <p>j) Procedure / Check list for pre-commissioning activities.</p> <p>k) Procedure / Check list for commissioning of the system.</p> <p>l) Safety precautions to be followed in electrical supply distribution during erection.</p>	

**B) OPERATION & MAINTENANCE MANUALS**

- a) 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.
- b) The arrangement and contents of O & M manuals shall be as follows:
  - 1) Chapter 1 - Plant Description: To contain the following sections specific to the equipment/system supplied
  - (a) Description of operating principle of equipment / system with schematic drawing / layouts.

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	<p>(b) Functional description of associated accessories / controls. Control interlock protection write up.</p> <p>(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).</p> <p>(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.</p> <p>(e) Design data against which the plant performance will be compared.</p> <p>(f) Master list of equipments, Technical specification of the equipment/system and approved data sheets.</p> <p>(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).</p> <p>(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).</p> <p>2) <u>Chapter 2.0 - Plant Operation:</u> To contain the following sections specific to the equipment supplied</p> <p>(a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.</p> <p>(b) Limiting values of all protection settings.</p> <p>(c) Various settings of annunciation/interlocks provided.</p> <p>(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.</p> <p>(e) Do's and Don'ts related to operation of the equipment.</p> <p>(f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.</p> <p>(g) Parameters to be monitored with normal value and limiting values.</p> <p>(h) Equipment isolating procedures.</p>	

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	<ul style="list-style-type: none"> <li>(i) Trouble shooting with causes and remedial measures.</li> <li>(j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.</li> <li>(k) Routine Operational Checks, Recommended Logs and Records</li> <li>(l) Change over schedule if more than one auxiliary for the same purpose is given.</li> <li>(m) Preservation procedure on long shut down.</li> <li>(n) System/plant commissioning procedure.</li> </ul> <p>3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied.</p> <ul style="list-style-type: none"> <li>(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. &amp; population.</li> <li>(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.</li> <li>(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.</li> <li>(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.</li> <li>(e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.</li> <li>(f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.</li> <li>(g) Long term maintenance schedules</li> <li>(h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.</li> <li>(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 &amp; at</li> </ul>	

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	<p>longer intervals to ensure trouble free operation and quantity required for complete replacement.</p> <p>(j) Tolerance for fitment of various components.</p> <p>(k) Details of sub vendors with their part no. in case of bought out items.</p> <p>(l) List of spare parts with their Part No, total population, life expediency &amp; their interchangeability with already supplied spares to NTPC.</p> <p>(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification &amp; quality plan for fast moving consumable spares.</p> <p>(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.</p> <p>(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.</p>	
8.03.03	<p>After finalization and approval of the Employer, the O &amp; 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 &amp; M manuals have been supplied to the Employer.</p> <p>If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &amp;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.</p>	
8.03.03	<b>PLANT HANDBOOK AND PROJECT COMPLETION REPORT</b>	
8.03.03.01	<p><b>PLANT HANDBOOK</b></p> <p>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</p> <p>i) Design and performance data.</p> <p>ii) Process &amp; Instrumentation diagrams.</p> <p>iii) Single line diagrams.</p>	
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	<ul style="list-style-type: none"> <li>iv) Sequence &amp; Protection Interlock Schemes.</li> <li>v) Alarm and trip values.</li> <li>vi) Performance Curves.</li> <li>vii) General layout plan and layout of main plant building and auxiliary buildings</li> <li>viii) Important Do's &amp; Don'ts</li> </ul> <p>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.</p>	
8.03.03.02	<b>PROJECT COMPLETION REPORT</b>  The Contractor shall submit a Project Completion Report at the time of handing over the plant.	
8.03.04	<b>DRAWINGS</b> <ul style="list-style-type: none"> <li>a) i) All the FGD 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.</li> <li>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 <b>Annexure-VI</b> 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.</li> </ul> <p>Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site.</p> <p>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.</p> <ul style="list-style-type: none"> <li>iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per <b>Annexure-VI</b> of Part-C.</li> <li>iv) Contractor shall prepare the model of all the facilities located in FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE (including all</li> </ul>	

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	<p>facilities), and any other facility in an integrated &amp; intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, intelligent P&amp;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.</p> <p>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 &amp; 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.</p> <p>b) All documents/text information shall be in latest version of MS Office / MS Excel / PDF FORMAT as applicable.</p> <p>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.</p> <p>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 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.</p> <p>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.</p>	

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	<p>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".</p> <p>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.</p> <p>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 &amp; 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.</p> <p>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.</p> <p>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 the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.</p> <p>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 &amp; Instrumentation Diagrams and/or the requirements cropping up for draining &amp; venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.</p>	

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8.04.00	<p>Assessing &amp; 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 &amp; equipment erection, subsequent system charging and its effective draining &amp; venting arrangement as per site suitability.</p> <p>j) As Built Drawings</p> <p>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 <b>Annexure VI</b>.</p> <p>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 &amp; facilities within his scope of work as well as interface engineering &amp; integration of systems, facilities, equipment &amp; works under Employer's scope and submit all necessary drawings/ documents for the same.</p> <p>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 of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.</p> <p>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.</p> <p>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.</p> <p><b>ENGINEERING INFORMATION SUBMISSION SCHEDULE</b></p>	

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	<p>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.</p> <ul style="list-style-type: none"> <li>i) Information that shall be submitted for the approval to the Employer before proceeding further, and</li> <li>ii) Information that would be submitted for Employer's information only.</li> </ul> <p>The Master Drawing List (MDL) shall be updated periodically and submitted to the employer, highlighting the changes made in MDL.</p> <p>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.</p>	
8.05.00	<b>ENGINEERING PROGRESS AND EXCEPTION REPORT</b>	
8.05.01	<p>The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including</p> <ul style="list-style-type: none"> <li>a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission</li> <li>b) Drawings which were not submitted as per agreed schedule.</li> </ul>	
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.	
<b>8.06.00</b>	<b>Engineering Co-ordination Procedure</b>	
8.06.01	<p>The following principal coordinators will be identified by respective organizations at time of award of contract:</p> <p>NTPC Engineering Coordinator (NTPC EC):</p> <p>Name : _____</p>	

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	<p>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".  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,</p>		
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	<p>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.</p> <p>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 &amp; facilities within his scope of work as well as interface engineering &amp; integration of systems, facilities, equipment &amp; works under Employer's scope and submit all necessary drawings/ documents for the same.</p> <p>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.</p> <p>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 :</p> <p>CATEGORY- I: Approved</p> <p>CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.</p> <p>CATEGORY -III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.</p> <p>CATEGORY -IV For information and records.</p> <p>h) Contractor shall resubmit the drawings approved under Category II, III &amp; 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</p>	

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	<p>Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. <b>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.</b></p> <p>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.</p> <p>j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I &amp; 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.</p> <p>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.</p> <p>l) These comments will be taken care by the contractor while submitting the revised drawing.</p> <p>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.</p>	
9.00.00	<b>TECHNICAL CO-ORDINATION MEETING</b>	
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 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.	
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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	<p><b>DESIGN IMPROVEMENTS</b></p> <p>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.</p> <p>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.</p>	
11.00.00	<p><b>EQUIPMENT BASES</b></p> <p>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 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.</p>	
12.00.00	<p><b>PROTECTIVE GUARDS</b></p> <p>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.</p>	
13.00.00	<p><b>LUBRICANTS, SERVO FLUIDS AND CHEMICALS</b></p>	
13.01.00	<p>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</p>	
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	<p>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.</p> <p>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.</p>	
13.02.00	<p>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.</p> <p>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.</p>	
14.00.00	<b>LUBRICATION</b>	
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	<b>MATERIAL OF CONSTRUCTION</b>	
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.	
16.00.00	<b>RATING PLATES, NAME PLATES &amp; LABELS</b>	
16.01.00	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.	
16.02.00	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.	

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16.03.00	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.	
16.04.00	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.	
16.05.00	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.	
16.06.00	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.	
16.07.00	<p>Safety and relief valves shall be provided with the following:</p> <ul style="list-style-type: none"> <li>a) Manufacturer's identification.</li> <li>b) Nominal inlet and outlet sizes in mm.</li> <li>c) Set pressure in Kg/cm<sup>2</sup> (abs).</li> <li>d) Blowdown and accumulation as percentage of set pressure.</li> <li>e) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.</li> </ul>	
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	<p><b>TOOLS AND TACKLES</b></p> <p>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,</p>	

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	<p>checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.</p> <p>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.</p>	
18.00.00	<b>WELDING</b>	
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	<b>COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES</b>	
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	<b>PROTECTION AND PRESERVATIVE SHOP COATING</b>	
20.01.00	<b>PROTECTION</b>	
	All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with 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	<b>PRESERVATIVE SHOP COATING</b>	
	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	

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	<p>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.</p> <p>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.</p>	
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	<b>QUALITY ASSURANCE PROGRAMME</b>	
21.01.00	<p>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 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:</p> <ul style="list-style-type: none"> <li>a) His organisation structure for the management and implementation of the proposed quality assurance programme</li> <li>b) Quality System Manual</li> <li>c) Design Control System</li> </ul>	
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	<p>d) Documentation Control System</p> <p>e) Qualification data for Bidder's key Personnel.</p> <p>f) 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.</p> <p>g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.</p> <p>h) Control of non-conforming items and system for corrective actions.</p> <p>i) Inspection and test procedure both for manufacture and field activities.</p> <p>j) Control of calibration and testing of measuring testing equipments.</p> <p>k) System for Quality Audits.</p> <p>l) System for indication and appraisal of inspection status.</p> <p>m) System for authorising release of manufactured product to the Employer.</p> <p>n) System for handling storage and delivery.</p> <p>o) System for maintenance of records, and</p> <p>p) 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 <b>Annexure-I</b> and <b>Annexure-II</b> respectively.</p>	
22.00.00	<b>GENERAL REQUIREMENTS - QUALITY ASSURANCE</b>	
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.	

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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 <b>Annexure-V</b> . The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.	
22.06.00	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.	
22.07.00	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	
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	Clearance Certificate (MDCC).	
22.08.00	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	
22.09.00	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.	
22.10.00	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.	
22.11.00	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.	
22.12.00	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	
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.	
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	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	<p>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 <b>Annexure-IV</b>. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.</p>	
22.18.00	<p>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.</p> <p>Such quality plans of the successful vendors shall be finalised with the Employer 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.</p>	
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	
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	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	<p><b>Environmental Stress Screening</b></p> <p>All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.</p> <p>1) The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.</p> <p style="text-align: center;"><b>Or</b></p> <p>In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.</p> <p><b><u>Elevated Temperature Test Cycle</u></b></p> <p>During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service</p>	
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	<p>with load on various components being equal to those which will be experienced in actual service.</p> <p>During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.</p> <p>In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.</p> <p><b>2) <u>Burn in Test Cycle</u></b></p> <p>The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.</p> <p>The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.</p> <p>During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.</p> <p>During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.</p>	
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.	
23.00.00	<b>QUALITY ASSURANCE DOCUMENTS</b>	
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.	
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23.01.01	<p>Each QA Documentation shall have a project specific Cover Sheet bearing name &amp; identification number of equipment and including an index of its contents with page control on each document.</p> <p>The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.</p> <p>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.</p>	
23.02.00	<p>Typical contents of QA Documentation is as below:-</p> <ul style="list-style-type: none"> <li>(a.) Quality Plan</li> <li>(b.) Material mill test reports on components as specified by the specification and approved Quality Plans.</li> <li>(c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.</li> <li>(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.</li> <li>(e.) Heat Treatment Certificate/Record (Time- temperature Chart)</li> <li>(f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).</li> <li>(g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.</li> <li>(h.) Certificate of Conformance (COC) wherever applicable.</li> <li>(i.) MDCC</li> </ul>	
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	
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	<p>supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.</p> <p>(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.</p> <p>(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.</p> <p>(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 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 &amp; 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.</p>	
23.05.00	<p><b>TRANSMISSION OF QA DOCUMENTATION</b></p> <p>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.</p> <p>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.</p>	
24.00.00	<p><b>PROJECT MANAGER'S SUPERVISION</b></p>	
24.01.00	<p>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.</p>	
24.02.00	<p>The work shall be performed under the supervision of the Project Manager.</p> <p>The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:</p>	

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	<ul style="list-style-type: none"> <li>(a.) Interpretation of all the terms and conditions of these documents and specifications</li> <li>(b.) Review and interpretation of all the Contractor's drawing, engineering data, etc</li> <li>(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</li> <li>(d.) Inspect, accept or reject any equipment, material and work under the contract</li> <li>(e.) Issue certificate of acceptance and/or progressive payment and final payment certificates</li> <li>(f.) Review and suggest modifications and improvement in completion schedules from time to time, and</li> <li>(g.) Supervise Quality Assurance Programme implementation at all stages of the works.</li> </ul>	
25.00.00	<b>INSPECTION, TESTING AND INSPECTION CERTIFICATES</b>	
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	

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	(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 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.	
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25.10.00	<b>Associated document for Quality Assurance programme</b>	
25.10.01	Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at <b>Annexure-I</b> .	
25.10.02	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at <b>Annexure-II</b> .	
25.10.03	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 ( <b>Annexure-III</b> ).	
25.10.04	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at <b>Annexure-IV</b> .	
25.10.05	Field Welding Schedule Format enclosed at <b>Annexure-V</b> .	
25.11.00	<b>Not Used</b>	
25.12.00	<b>DEMONSTRATION OF APPLICATION ENGINEERING</b>	
25.12.01	<p>Based on NTPC inputs, the Contractor shall prepare and submit typical implemented scheme in their system (Control system &amp; HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following.</p> <p>(i) Logics/Loops:</p> <ul style="list-style-type: none"> <li>a) Drive logics implementation for each type of binary drive along with its display in HMI.</li> <li>b) Sequence implementation along with its display in HMI.</li> <li>c) Single non-cascade controller implementation.</li> <li>d) Cascade loop implementation.</li> <li>e) Master slave implementation with different slave combination.</li> <li>f) Temperature &amp; pressure compensation for flow signals &amp; pressure compensation for level signals as applicable.</li> </ul> <p>(ii) HMI Functions:</p> <ul style="list-style-type: none"> <li>a) LVS Annunciation.</li> <li>b) Graphics.</li> <li>c) HSR</li> <li>d) Logs/Reports.</li> </ul>	

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25.12.02	<p>e) Calculations ( Basic &amp; Performance Calculations).</p> <p>The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.</p> <p>After review and finalization of the typical cases, the implementation of each logic &amp; control loop shall be carried out by the Contractor based on NTPC inputs. After implementation of these logics &amp; 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 &amp; the results shall be documented as part of test report.</p>	
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	<b>PRE-COMMISSIONING AND COMMISSIONING FACILITIES</b>	
26.01.00	<p>(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.</p> <p>(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.</p> <p>(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.</p>	

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	<p>(d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.</p> <p>(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.</p> <p>(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 running at the base load, peak load as well as lowest sustained operating condition as far as practicable.</p>	
26.01.00	<p>Contractor shall furnish the commissioning organization chart for review &amp; acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain:</p> <ol style="list-style-type: none"> <li>(1.) Biodata including experience of the Commissioning Engineers.</li> <li>(2.) Role and responsibilities of the Commissioning Organisation members.</li> <li>(3.) Expected duration of posting of the above Commissioning Engineers at site.</li> </ol>	
26.02.00	<p><b>Initial Operation</b></p> <p>(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.</p> <p>(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 FGD System shall operate continuously at full load for a period not less than 72 hours.</p> <p>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.</p>	

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	<p>The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.</p> <p>(c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation.</p> <p>(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 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.</p>	
26.03.00	<p><b>Guarantee Tests</b></p> <p>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 <b><u>three (3) months</u></b> after the successful completion of Initial Operations. Any extension of time beyond the above <b><u>three (3) months</u></b> shall be mutually agreed upon.</p> <p>b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.</p> <p>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.</p> <p>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.</p>	

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27.00.00	<p>e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.</p> <p><b>TAKING OVER</b></p> <p>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 withheld 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.</p>	
28.00.00	<b>TRAINING OF EMPLOYER'S PERSONNEL</b>	
28.01.00	<p><b>Training for Employers O&amp;M Personnel</b></p> <p>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 &amp; Maintenance.</p> <p>Such training should enable the personnel to individually take the responsibility of operating and maintaining the FGD system in a manner acceptable to the Employer.</p>	
28.02.00	<p><b>Training for Employers Engineering Personnel</b></p> <p>The scope of services under training for Employer's engineering personnel shall also necessarily include two (2) manmonth. This shall cover all disciplines viz, Mechanical, Electrical, C&amp;I, &amp; 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.</p>	
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 man months (7 man months in case of projects where ZLD system is included in scope) and 3 man months ( 4 man months in case of projects where ZLD system is included in scope) respectively for O&M and	
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	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.  <b>Note:</b> For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.	
29.00.00	<b>SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION</b>  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	<b>NOISE LEVEL</b>  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 . However for Ball Mills & crushers the noise levels as per following shall also be acceptable:  a) Ball Mill < 90 dBA b) Crusher : 100 dBA	

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31.00.00	<p><b>PACKAGING AND TRANSPORTATION</b></p> <p>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 &amp; 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.</p>									
32.00.00	<p><b>ELECTRICAL EQUIPMENTS/ENCLOSURES</b></p>									
32.01.00	<p>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.</p>									
33.00.00	<p><b>INSTRUMENTATION AND CONTROL</b></p> <p>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.</p>									
33.01.00	<p>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.</p> <p>All scales and charts shall be calibrated and printed in Metric Units as follows:</p> <table> <tbody> <tr> <td>1. Temperature</td> <td>- Degree centigrade (deg C)</td> </tr> <tr> <td>2. Pressure</td> <td>- Kilograms per square centimetre (Kg/cm<sup>2</sup>). 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.</td> </tr> <tr> <td>3. Draught</td> <td>- Millimetres of water column (mm wc).</td> </tr> <tr> <td>4. Vacuum</td> <td>- Millimeters of mercury gauge (mm Hg)</td> </tr> </tbody> </table>	1. Temperature	- Degree centigrade (deg C)	2. Pressure	- Kilograms per square centimetre (Kg/cm <sup>2</sup> ). 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)	
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	<p>or water column (mm Wcl).</p> <p>5. Flow (Gas) - Tonnes/ hour</p> <p>6. Flow (Steam) - Tonnes/ hour</p> <p>7. Flow (Liquid) - Tonnes / hour</p> <p>8. Flow base - 760 mm Hg. 0 deg.C</p> <p>9. Density - Grams per cubic centimeter.</p>	
33.02.00	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	<p><b>ELECTRICAL NOISE CONTROL</b></p> <p>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).</p>	
35.00.00	<p><b>SURGE PROTECTION FOR SOLID STATE EQUIPMENT</b></p> <p>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.</p>	
36.00.00	<p><b>INSTRUMENT AIR SYSTEM</b></p> <p>The instrument air supply system as supplied by the Bidder for various pneumatic control &amp; instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.</p>	
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37.00.00	<p>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.</p> <p><b>TAPPING POINTS FOR MEASUREMENTS</b></p> <p>Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.</p> <p>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.</p> <p>The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.</p> <ul style="list-style-type: none"> <li>i) Temperature test pockets with stub and thermowell</li> <li>ii) Pressure test pockets</li> </ul>	
38.00.00	<p><b>SYSTEM DOCUMENTATION</b></p> <p>The Bidder shall provide drawings, system overview &amp; description, hardware/software details, technical literature, functional &amp; hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C&amp; I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&amp;I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation &amp; Maintenance (including quick diagnostics &amp; trouble shooting) of these C&amp;I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&amp;I systems shall be as stipulated under C&amp;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.</p> <p>The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.</p>	
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	<p><b>MAINTENANCE MANUALS OF ELECTRONIC MODULES</b></p> <p>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</p>	

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	<p>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.</p>		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	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

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965
	IS:2825	Code for unfired vessels	
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water	
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose	
	IS:1601	Specification for performance of constant speed IC Engines for general Purpose	
	IS:1893	Criteria for earthquake resistant design of structures	
	IS1978-1971	Line Pipe April 1969.	API Standards 5L
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968
	IS:2312	Propellant type Ventilation fans	
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	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 monocrystallines 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		
	IS:4540	Specification for monory-stallines rectifire assembly equipment	
	IS:4671	Expanded polystyrene for thermal insulation purpose	
	IS:4736	Hot dip zinc coating on steel tubes	
	IS:4894	Centrifugal fans	
	IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)	
	IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958
	IS:6392	Steel pipe flanges	BS 4504 : 1969
	IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956
	IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524
	IS:7373	Specification for wrought aluminium and aluminium sheet and strips	
	IS:7938	Air receivers for compressed air installation	
	ISO:1217	Displacement compressor-Accepance test	
	ASHRAE-33	Methods of testing for rating of forced circulation air cooling and air heating coils.	
	ASHRAE-52-76	Air cleaning device used in general ventilation for removing particle matter.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
	<p>ASHRAE-22-72      Method of testing for rating of water cooled refrigerant condensers.</p> <p>ASHRAE 23-67      Methods of testing for rating of positive displacement refrigerant compressors.</p> <p>ARI-450-6      Standard for water cooled refrigerant condensers.</p> <p>ARI-550      Standard for centrifugal water chilling packages.</p> <p>ARI-410      Standard for forced circulation air cooling and air heating coils</p> <p>ARI-430/435      Central station AHU/Application of Central Station AHU Fans BS:848 (Part-1,2)</p> <p>BS:400      Low carbon steel cylinders for the storage &amp; transport of permanent gases.</p> <p>BS:401      Low carbon steel cylinders for the storage &amp; transport of liquified gases.</p> <p>CTI Code ACT-105      Acceptance test code for Water Cooling Tower.</p> <p>ANSI-31.5      Refrigerant piping</p> <p>ASME-PTC-23-1958      Atmospheric Water Cooling Equipment</p> <p>AMCA A-21C      Test Code for air moving devices</p> <p>API:618      Reciprocating Compressor for general refinery services.</p> <p><b>HYDRAULIC INSTITUTE STANDARDS.</b></p> <p><b>HYDRANT SYSTEM MANUALS OF TAC.</b></p> <p><b>TAC MANUALS OF SPRAY SYSTEM</b></p> <p><b>NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.</b></p> <p><b>INDIAN EXPLOSIVES ACT.</b></p> <p><b>INDIAN FACTORIES ACT.</b></p> <p><b>STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.</b></p>

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	<b>CODE AND STANDARD FOR CIVIL WORKS</b>	
	Some of the applicable Standards, Codes and references are as follows:	
	<b>Excavation &amp; Filling</b>	
	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.
	<b>Properties, Storage and Handling of Common Building Materials</b>	
	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	
	<p>(Part-II) Calcined clay based.</p> <p>IS: 1542 Specification for sand for plaster.</p> <p>IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement.</p> <p>IS: 1786 Specification for high strength deformed bars for concrete reinforcement.</p> <p>IS: 2062 Specification for steel for general structural purposes.</p> <p>IS: 2116 Specification for sand for masonry mortars.</p> <p>IS: 2386 Testing of aggregates for concrete. (Parts-I to VIII)</p> <p>IS: 3150 Hexagonal wire netting for general purpose.</p> <p>IS: 3495 Methods of tests of burnt clay building bricks. (Parts-I to IV)</p> <p>IS: 3812 Specification for fly ash, for use as pozzolana and admixture.</p> <p>IS: 4031 Methods of physical tests for hydraulic cement.</p> <p>IS: 4032 Methods of chemical analysis of hydraulic cement.</p> <p>IS: 4082 Recommendations on stacking and storage of construction materials at site.</p> <p>IS: 8112 Specification for 43 grade ordinary portland cement.</p> <p>IS: 8500 Medium and high strength structural steel.</p> <p>IS: 12269 53 grade ordinary portland cement.</p> <p>IS: 12894 Specification for Fly ash lime bricks.</p> <p><b>Cast-In-Situ Concrete and Allied Works</b></p> <p>IS: 280 Specification for mild steel wire for general engineering purposes.</p> <p>IS: 456 Code of practice for plain and reinforced concrete.</p>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>IS: 457 Code of practice for general construction of plain &amp; reinforced concrete for dams &amp; other massive structures.</p> <p>IS: 516 Method of test for strength of concrete.</p> <p>IS: 650 Specification for standard sand for testing of cement.</p> <p>IS: 1199 Methods of sampling and analysis of concrete.</p> <p>IS: 1791 General requirements for batch type concrete mixers.</p> <p>IS: 1838 (Part-I) Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).</p> <p>IS: 2204 Code of practice for construction of reinforced concrete shell roof.</p> <p>IS: 2210 Criteria for the design of reinforced concrete shell structures and folded plates.</p> <p>IS: 2438 Specification for roller pan mixer.</p> <p>IS: 2502 Code of practice for bending and fixing of bars for concrete reinforcement.</p> <p>IS: 2505 General requirements for concrete vibrators, immersion type.</p> <p>IS: 2506 General requirements for concrete vibrators, screed board type.</p> <p>IS: 2514 Specification for concrete vibrating tables.</p> <p>IS: 2645 Specification for Integral cement water proofing compounds.</p> <p>IS: 2722 Specification for portable swing weigh batches for concrete. (single and double bucket type)</p> <p>IS: 2750 Specification for Steel scaffolding.</p> <p>IS: 2751 Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.</p> <p>IS: 3025 Methods of sampling and test waste water.</p> <p>IS: 3366 Specification for Pan vibrators.</p> <p>IS: 3370 Code of practice for concrete structures for the storage of</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>(Part I to IV) liquids.</p> <p>IS: 3414 Code of practice for design and installation of joints in buildings.</p> <p>IS: 3550 Methods of test for routine control for water used in industry.</p> <p>IS: 3558 Code of practice for use of immersion vibrators for consolidating concrete.</p> <p>IS: 4014 (Parts I &amp; II) Code of practice for steel tubular scaffolding.</p> <p>IS: 4326 of buildings. Code of practice for earthquake resistant design and construction</p> <p>IS: 4461 Code of practice for joints in surface hydro-electric power stations.</p> <p>IS: 4656 Specification for form vibrators for concrete.</p> <p>IS: 4925 Specification for batching and mixing plant.</p> <p>IS: 4990 Specification for plywood for concrete shuttering work.</p> <p>IS: 4995 (Parts I &amp; II) Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.</p> <p>IS: 5256 Code or practice for sealing joints in concrete lining on canals.</p> <p>IS: 5525 concrete work. Recommendations for detailing of reinforcement in reinforced</p> <p>IS: 5624 Specification for foundation bolts.</p> <p>IS: 6461 Glossary of terms relating to cement concrete.</p> <p>IS: 6494 Code of practice for water proofing of underground water reservoirs and swimming pools.</p> <p>IS: 6509 Code of practice for installation of joints in concrete pavements.</p> <p>IS: 7861 Code of practice for extreme weather concreting. (Parts I &amp; II)</p> <p>IS: 9012 Recommended practice for shot concreting.</p> <p>IS: 9103 Specification for admixtures for concrete.</p>		

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>IS: 9417 Recommendations for welding cold worked steel bars for reinforced concrete construction.</p> <p>IS: 10262 Recommended guidelines for concrete mix design.</p> <p>IS: 11384 Code of practice for composite construction in structural steel and concrete.</p> <p>IS: 11504 Criteria for structural design of reinforced concrete natural draught cooling towers.</p> <p>IS: 12118 Specification for two-parts poly sulphide.</p> <p>IS: 12200 Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.</p> <p>IS: 13311 Method of non-destructive testing of concrete.</p> <p>Part-1 Ultrasonic pulse velocity.</p> <p>Part-2 Rebound hammer.</p> <p>SP:23 Handbook of concrete mixes</p> <p>SP: 24 Explanatory Handbook on IS: 456-1978</p> <p>SP: 34 Handbook on concrete reinforcement and detailing.</p> <p><b>Precast Concrete Works</b></p> <p>SP: 7(PartVI/ National Building Code- Structural design of prefabrication and Sec.7) systems building.</p> <p>IS: 10297 Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.</p> <p>IS: 10505 Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.</p> <p><b>Masonry and Allied Works</b></p> <p>IS: 1905 Code of Practice for Structural Safety of Buildings-Masonry walls.</p> <p>IS: 2212 Code of Practice for Brickwork.</p>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>IS: 2250 Code of Practice for Preparation and use of Masonry Mortar.</p> <p>SP: 20 Explanatory hand book on masonry code.</p> <p><b>Sheeting Works</b></p> <p>IS:277 Galvanised steel sheets (plain or corrugated).</p> <p>IS: 459 Unreinforced corrugated and semi-corrugated asbestos cement sheets.</p> <p>IS: 513 Cold-rolled carbon steel sheets.</p> <p>IS: 730 Specification for fixing accessories for corrugated sheet roofing.</p> <p>IS: 1626 Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.</p> <p>IS: 2527 Code of practice for fixing rain water gutters and down pipe for roof drainage.</p> <p>IS: 3007 Code of practice for laying of asbestos cement sheets.</p> <p>IS: 5913 Methods of test for asbestos cement products.</p> <p>IS: 7178 Technical supply conditions for tapping screw.</p> <p>IS: 8183 Bonded mineral wool.</p> <p>IS: 8869 Washers for corrugated sheet roofing.</p> <p>IS: 12093 Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.</p> <p>IS: 12866 Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced).</p> <p>IS: 14246 Specification for continuously pre-painted galvanised steel sheets and coils.</p> <p><b>Fabrication and Erection of Structural Steel Work</b></p> <p>IS: 2016 Specification for plain washers.</p>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	નાનીયિકી NTPC
	<p>IS: 814 Specification for covered Electrodes for Metal Arc Welding for weld steel.</p> <p>IS: 1852 Specification for Rolling and Cutting Tolerances for Hot rolled steel products.</p> <p>IS: 3502 Specifications for chequered plate.</p> <p>IS: 6911 Specification for stainless steel plate, sheet and strip.</p> <p>IS: 3757 Specification for high strength structural bolts</p> <p>IS: 6623 Specification for high strength structural nuts.</p> <p>IS: 6649 High Tensile friction grip washers.</p> <p>IS: 800 Code of practice for use of structural steel in general building construction.</p> <p>IS: 816 Code of practice for use of Metal Arc Welding for General Construction.</p> <p>IS: 4000 Code of practice for assembly of structural joints using high tensile friction grip fasteners.</p> <p>IS: 9595 Code of procedure of Manual Metal Arc Welding of Mild Steel.</p> <p>IS: 817 Code of practice for Training and Testing of Metal Arc Welders.</p> <p>IS: 1811 Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).</p> <p>IS: 9178 Criteria for Design of steel bins for storage of Bulk Materials.</p> <p>IS: 9006 Recommended Practice for Welding of Clad Steel.</p> <p>IS: 7215 Tolerances for fabrication steel structures.</p> <p>IS: 12843 Tolerance for erection of structural steel.</p> <p>IS: 4353 Recommendations for submerged arc welding of mild steel and low alloy steels.</p> <p>SP: 6 (Part 1 to 7) ISI Hand book for structural Engineers.</p>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	NTPC
	<p>IS: 1608                    Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.</p> <p>IS: 1599                    Method of Bend Tests for Steel products other than sheet, strip, wire and tube</p> <p>IS : 228                    Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.</p> <p>IS : 2595                    Code of Practice for Radio graphic testing.</p> <p>IS : 1182                    Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.</p> <p>IS : 3664                    Code of practice for Ultra sonic Testing by pulse echo method.</p> <p>IS : 3613                    Acceptance tests for wire flux combination for submerged Arc Welding.</p> <p>IS : 3658                    Code of practice for Liquid penetrant Flaw Detection.</p> <p>IS : 5334                    Code of practice for Magnetic Particle Flaw Detection of Welds.</p>	
	<b>Plastering and Allied Works</b>	
	<p>IS : 1635                    Code of practice for field slaking of Building lime and preparation of putty.</p> <p>IS : 1661                    Application of cement and cement lime plaster finishes.</p> <p>IS : 2333                    Plaster-of-paris.</p> <p>IS : 2402                    Code of practice for external rendered finishes.</p> <p>IS : 2547                    Gypsum building plaster.</p> <p>IS : 3150                    Hexagonal wire netting for general purpose.</p>	
	<b>Acid and Alkali Resistant Lining</b>	
	<p>IS : 158                    Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali &amp; heat resisting.</p> <p>IS : 412                    Specification for expanded metal steel sheets for general purpose.</p>	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	નાનીયિકી NTPC
	<p>IS : 4441      Code of practice for use of silicate type chemical resistant mortars.</p> <p>IS : 4443      Code of practice for use of resin type chemical resistant mortars.</p> <p>IS : 4456      Method of test for chemical resistant tiles. (Part I &amp; II)</p> <p>IS : 4457      Specification for ceramic unglazed vitreous acid resistant tiles.</p> <p>IS : 4832      Specification for chemical resistant mortars.</p> <p>                    Part I      Silicate type</p> <p>                    Part II     Resin type</p> <p>                    Part III    Sulphur type</p> <p>IS : 4860      Specification for acid resistant bricks.</p> <p>IS : 9510      Specification for bitumasic, Acid resisting grade.</p> <p><b>Water Supply, Drainage and Sanitation</b></p> <p>IS : 458      Specification for concrete pipes.</p> <p>IS : 554      Dimensions for pipe threads, where pressure tight joints are made on thread.</p> <p>IS : 651      Specification for salt glazed stoneware pipes.</p> <p>IS : 774      Flushing cisterns for water closets and urinals.</p> <p>IS : 775      Cast iron brackets and supports for wash basins and sinks.</p> <p>IS : 778      Copper alloy gate, globe and check valves for water works purposes.</p> <p>IS : 781      Cast copper alloy screw down bib taps and stop valves for water services.</p> <p>IS : 782      Caulking lead.</p> <p>IS : 783      Code of practice for laying of concrete pipes.</p>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>IS : 1172 Basic requirements for water supply, drainage and sanitation.</p> <p>IS : 1230 Cast iron rain water pipes and fittings.</p> <p>IS : 1239 Mild steel tubes, tubulars and other wrought steel fittings.</p> <p>IS : 1536 Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.</p> <p>IS : 1537 Vertically cast iron pressure pipes for water, gas and sewage.</p> <p>IS : 1538 Cast iron fittings for pressure pipe for water, gas and sewage.</p> <p>IS : 1703 Ball valves (horizontal plunger type) including float for water supply purposes.</p> <p>IS : 1726 Cast iron manhole covers and frames.</p> <p>IS : 1729 Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.</p> <p>IS : 1742 Code of practice for building drainage.</p> <p>IS : 1795 Pillar taps for water supply purposes.</p> <p>IS : 1879 Malleable cast iron pipe fittings.</p> <p>IS : 2064 Code of practice for selection, installation and maintenance of sanitary appliances.</p> <p>IS : 2065 Code of practice for water supply in building.</p> <p>IS : 2326 Automatic flushing cisterns for urinals.</p> <p>IS : 2470 (Part-I &amp; II) Code of practice for installation of septic tanks.</p> <p>IS : 2501 Copper tubes for general engineering purposes.</p> <p>IS : 2548 Plastic seat and cover for water-closets.</p> <p>IS : 2556 (Part 1 to 15) Vitreous sanitary appliances (vitreous china).</p> <p>IS : 2963 Non-ferrous waste fittings for wash basins and sinks.</p>	

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

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS				
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.					
<b>Doors, Windows and Allied Works</b>					
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      Specification for timber panelled and glazed shutters- Part-I door      (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      Specification for wooden flush door shutters (solid core type); (Part-II)      particle board face panels and hard board face panels					
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	નાનીયિકી NTPC
	<p>IS:2209 Mortice locks (vertical type).</p> <p>IS:2553 Safety glass</p> <p>IS:2835 Flat transparent sheet glass.</p> <p>IS:3548 Code of practice for glazing in buildings.</p> <p>IS:3564 Door closers (Hydraulically regulated).</p> <p>IS : 3614 Fire check doors; plate, metal covered and rolling type.</p> <p>IS:4351 Steel door frames.</p> <p>IS:5187 Flush bolts.</p> <p>IS:5437 Wired and figured glass</p> <p>IS:6248 Metal rolling shutters and rolling grills.</p> <p>IS:6315 Floor springs (hydraulically regulated) for heavy doors.</p> <p>IS:7196 Hold fasts.</p> <p>IS:7452 Hot rolled steel sections for doors, windows and ventilators.</p> <p>IS:10019 Mild steel stays and fasteners.</p> <p>IS:10451 Steel sliding shutters (top hung type).</p> <p>IS:10521 Collapsible gates.</p> <p><b>Rooftop Water Proofing and Allied Works</b></p> <p>IS:1203 Methods of testing tar and bitumen.</p> <p>IS:1322 Specification for bitumen felts for water proofing and damp proofing.</p> <p>IS:1346 Code of practice for water proofing of roofs with bitumen felts.</p> <p>IS:1580 Specification for bituminous compound for water proofing and caulking purposes.</p>	

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS:3067 Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.</p> <p>IS:3384 Specification for bitumen primer for use in water proofing and damp proofing.</p> <p><b>Floor Finishes and Allied Works</b></p> <p>IS:1237 Specification for cement concrete flooring tiles.</p> <p>IS:1443 Code of practice for laying and finishing of cement concrete flooring tiles.</p> <p>IS:2114 Code of practice for laying in-situ terrazzo floor finish.</p> <p>IS:2571 Code of practice for laying in-situ cement concrete flooring.</p> <p>IS:3462 Specification for unbacked flexible PVC flooring.</p> <p>IS:4971 Recommendations for selection of industrial floor finishes.</p> <p>IS:5318 Code of practice for laying of flexible PVC sheet and tile flooring.</p> <p>IS:8042 Specification for white portland cement.</p> <p>IS:13801 Specification for chequered cement concrete flooring tiles.</p> <p><b>Painting and Allied Works</b></p> <p>IS:162 Specification for fire resisting silicate type, brushing, for use on wood, colour as required.</p> <p>IS:1477 Code of practice for painting of ferrous metals in buildings.</p> <p>Part-I Pretreatment.</p> <p>Part-II Painting.</p> <p>IS:1650 Specification for colours for building and decorative finishes.</p> <p>IS:2074 Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.</p> <p>IS:2338 Code of practice for finishing of wood and wood based materials.</p> <p>Part-I Operations and workmanship</p>		

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	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.
	<b>Piling and Foundation</b>	
	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.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.
	Part-I	Shallow foundations.
	Part-II	Deep foundations.
	IS:12070	Code of practice for design and construction of shallow foundations on rocks.
	DIN:4024	Flexible supporting structures for machines with rotating machines.
	VDI:2056	Criteria for assessing mechanical vibrations of machines.
	VDI:2060	Criteria for assessing rotating imbalances in machines.
	<b>Stop Log and Trash Rack</b>	
	IS:4622	Recommendations for fixed - wheel gates structural design.
	IS:5620	Recommendations for structural design criteria for low head slide gates.
	IS:11388	Recommendations for design of trash rack for intakes.
	IS:11855	General requirements for rubber seals for hydraulic gates.
	<b>Roads</b>	
	IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.
	IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.
	IRC:16	Specification for priming of base course with bituminous primers.
	IRC:19	Standard specifications and code of practice for water bound macadam.
	IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).
	IRC:34	Recommendations for road construction in waterlogged areas.
	IRC:36	Recommended practice for the construction of earth embankments for road works.
	IRC:37	Guidelines for the Design of flexible pavements.
	IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
	IRC:73	Geometric design standards for rural (non-urban) highways.
	IRC:86	Geometric Design standards for urban roads in plains.

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	<p>IRC:SP:13 Guidelines for the design of small bridges &amp; culverts.</p> <p>IRC - Public- Ministry of Surface Transport (Roads Wing), Specifications ation for road and bridge works.</p> <p>IS:73 Specification for paving bitumen</p> <p><b>Loadings</b></p> <p>IS:875 Code of practice for design loads other than earthquake) for (Pt. I to V) buildings and structures.</p> <p>IS:1893 Criteria for earthquake resistant design of structures.</p> <p>IS:4091 Code of Practice for design and construction of foundation for transmission line towers &amp; poles.</p> <p>IRC:6 Standard specifications &amp; code of practice for road bridges, Section-II Loads and stresses.</p> <p>M.O.T. Deptt. of railways Bridge Rules.</p> <p><b>Safety</b></p> <p>IS:3696 Safety code for scaffolds and ladders. (Part I &amp; II)</p> <p>IS:3764 Safety code for excavation work.</p> <p>IS:4081 Safety code for blasting and related drilling operations.</p> <p>IS:4130 Safety code for demolition of buildings.</p> <p>IS:5121 Safety code for piling and other deep foundations.</p> <p>IS:5916 Safety code for construction involving use of hot bituminous materials.</p> <p>IS:7205 Safety code for erection on structural steelwork.</p> <p>IS:7293 Safety code for working with construction machinery.</p> <p>IS:7969 Safety code for handling and storage of building materials</p> <p>IS:11769 Guidelines for safe use of products containing asbestos. - Indian Explosives Act. 1940 as updated.</p> <p><b>Architectural design of buildings</b></p> <p>SP:7 National Building Code of India</p> <p>SP:41 Hand book on functional requirements of buildings (other than industrial buildings)</p>	

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	<p><b>Miscellaneous</b></p> <p>IS:802 Code of practice for use of structural steel in overhead transmission line towers.</p> <p>(Relevant parts)</p> <p>IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.</p> <p>IS:10430 Creteria for design of lined canals and liner for selection of type of lining.</p> <p>IS:11592 Code of practice for selection and design of belt conveyors.</p> <p>IS:12867 PVC handrails covers.</p> <p>CIRIA Design and construction of buried thin-wall pipes.</p> <p>Publication</p>			
	<p><b>REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION</b></p>			
	<p>The design, manufacture, inspection, testing &amp; 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.</p>			
	<p><b>Temperature Measurements</b></p> <ol style="list-style-type: none"> <li>1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).</li> <li>2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.</li> <li>3. Temperature measuremnet by electrical Resistance thermometers - IS:2806.</li> <li>4. Thermometer - element - Platinum resistance - IS:2848.</li> </ol> <p><b>Pressure Measurements</b></p> <ol style="list-style-type: none"> <li>1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). <ol style="list-style-type: none"> <li>b) Electronic transmitters BS:6447.</li> </ol> </li> <li>2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.</li> <li>3. Process operated switch devices (Pr. Switch) BS-6134.</li> </ol>			
	LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 69 OF 83

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	<p><b>Flow Measurements</b></p> <p>Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II.</p> <p>Measurement of fluid flow in closed conduits - BS-1042.</p> <p><b>Electronic Measuring Instrument &amp; Control Hardware/ Software</b></p> <ol style="list-style-type: none"> <li>1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319.</li> <li>2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974.</li> <li>3. Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975.</li> <li>4. Dynamic response testing of process control instrumentation ISA - S 26 (1968).</li> <li>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.</li> <li>6. Printed circuit boards - IPC TM - 650, IEC 326 C.</li> <li>7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973.</li> <li>8. Edge socket connectors - IEC 130-11.</li> <li>9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.</li> <li>10. Dimensions of attachment plugs &amp; receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980).</li> <li>11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R).</li> <li>12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990.</li> <li>13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989.</li> <li>14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985.</li> <li>15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.</li> </ol>	

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	<p>16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985.</p> <p>17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985.</p> <p>18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984.</p> <p>19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983.</p> <p>20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978.</p> <p>21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987.</p> <p>22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.</p> <p><b>Instrument Switches and Contact</b></p> <ol style="list-style-type: none"> <li>1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000.</li> <li>2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600.</li> </ol> <p><b>Enclosures</b></p> <ol style="list-style-type: none"> <li>1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13).</li> <li>2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972).</li> <li>3. Protection class for Enclosures, cabinets, control panels &amp; desks - IS:2147 - 1962.</li> </ol> <p><b>Apparatus, enclosures and installation practices in hazardous area</b></p> <ol style="list-style-type: none"> <li>1. Classification of hazardous area - NFPA 70 - 1984, Article 500.</li> <li>2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973.</li> <li>3. Intrinsically safe apparatus - NFPA 493 1978.</li> <li>4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982.</li> <li>5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.</li> </ol>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	નાનીયિકી NTPC
	<p><b>Sampling System</b></p> <ol style="list-style-type: none"> <li>1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316.</li> <li>2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977.</li> <li>3. Water and steam in power cycle - ASME PTC 19.11.</li> <li>4. Standard methods of sampling system - ASTM D 1066-99.</li> </ol> <p><b>Annunciators</b></p> <ol style="list-style-type: none"> <li>1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979.</li> <li>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</li> <li>3. Damp heat cycling test - IS:2106</li> <li>4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78</li> </ol> <p><b>Protections</b></p> <ol style="list-style-type: none"> <li>1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989.</li> <li>2. General requirements &amp; tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973.</li> <li>3. Turbine water damage prevention - ASME TDP-1-1980.</li> <li>4. Boiler safety interlocks - NFPA 85 - 2011 or latest version.</li> </ol> <p><b>UPS System</b></p> <ol style="list-style-type: none"> <li>1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973.</li> <li>2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983.</li> <li>3. Surge withstand capability test - ANSI C 37.90 1 -1989.</li> <li>4. Performance testing of UPS - IEC 146.</li> <li>5. Stationary cells &amp; Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.</li> </ol>	

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	<p>6. Recommended practice for sizing large lead storage batteries for generating stations &amp; sub-stations - IEEE-485-1985.</p> <p>7. Printed Circuit Board - IPC TM 650, IEC 326C.</p> <p>8. General Requirements &amp; tests for printed wiring boards, IS:7405 (Part-I) 1973.</p> <p><b>Control Valves</b></p> <p>1. Control valve sizing - Compressible &amp; Incompressible fluids - ISA S 75.01-1985.</p> <p>2. Face to face dimensions of control valves - ANSI B 16.00 - 1973.</p> <p>3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2).</p> <p>4. Codes for pressure piping - ANSI B 31.1</p> <p>5. Control Valve leak class - ISA RP 39.6</p> <p><b>Process Connection &amp; Piping</b></p> <p>1. Codes for pressure piping "power piping" - ANSI B 31.1.</p> <p>2. Seamless carbon steel pipe ASTM - A - 106.</p> <p>3. Forged &amp; Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182.</p> <p>4. Material for socket welded fittings - ASTM - A - 105.</p> <p>5. Seamless ferritic alloy steep pipe - ASTM - A - 335.</p> <p>6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234.</p> <p>7. Composition bronze of ounce metal castings - ASTM - B - 62.</p> <p>8. Seamless Copper tube, bright annealed - ASTM - B - 168.</p> <p>9. Seamless copper tube - ASTM - B - 75.</p> <p>10. Dimension of fittings - ANSI - B - 16.11.</p> <p>11. Valves flanged and butt welding ends - ANSI - B - 16.34.</p> <p><b>Instrument Tubing</b></p> <p>1. Seamless carbon steel pipe - ASTM - A 106.</p> <p>2. Material of socketweld fittings - ASTM - A105.</p> <p>3. Dimensions of fittings - ANSI - B - 16.11.</p>	

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	<p>4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1.</p> <p><b>Cables</b></p> <ol style="list-style-type: none"> <li>1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992.</li> <li>2. Requirements for copper conductor-Wiring cables for telecommunications &amp; information processing system - VDE:0815.</li> <li>3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83.</li> <li>4. Insulation &amp; Sheathing compounds for cables : VDE 0207 (Part-4, 5 &amp; 6).</li> <li>5. Guide design and installation of cable systems in power generating stations ( insulation, jacket materials) - IEEE Std. 422-1977.</li> <li>6. Rules for Testing insulated cables and flexible cables : VVDE - 0472</li> <li>7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)</li> <li>8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81.</li> <li>9. Oxygen index and temperature index test - ASTM D - 2863.</li> <li>10. Smoke density measurement test - ASTMD - 2843.</li> <li>11. Acid gas generation test - IEC - 754 - 1.</li> <li>12. Swedish Chimney test - SEN - 4241475 (F3).</li> <li>13. Teflon (FEP) insulation &amp; sheath test - ASTMD - 2116.</li> <li>14. Thermocouple compensating cables - Testing requirements &amp; sampling plan IS:8784.</li> <li>15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I).</li> </ol> <p><b>Cable Trays, Conduits</b></p> <ol style="list-style-type: none"> <li>1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984.</li> <li>2. -do- Test Standards. NEMA VE-1-1979.</li> <li>3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTMA - 386-78.</li> </ol>	

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	<p><b>Public Address System</b></p> <ol style="list-style-type: none"> <li>1. Specifications for lod speakers - IS:7741 (Part-I, II and III)</li> <li>2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301</li> <li>3. Specification for Public Address Amplifiers - IS:10426.</li> <li>4. Code of practice for outdoor installation of PA system - IS:1982.</li> <li>5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881.</li> <li>6. Basic environmental testing procedures for electronic and electrical items - IS:9000.</li> <li>7. Characteristics and methods of measurements for sound system equipment - IS:9302</li> <li>8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732</li> <li>9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II)</li> <li>10. Fittings for rigid steel conduits for electrical wiring - IS:2667</li> <li>11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147.</li> </ol> <p><b>Vibration Monitoring System</b></p> <ol style="list-style-type: none"> <li>1. API 670 - 1994</li> <li>2. BS : 4675 Part-2</li> </ol>	

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## **ANNEXURE-I**

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

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

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ENGG. DIV./QA&I

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ANNEXURE-II

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN				PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:			
		ITEM : SUB-SYSTEM:	QP NO.: REV. NO.: DATE: 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)	NTPC	DOC. NO.:	REV.....
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER				
SIGNATURE			FOR NTPC USE	REVIEWED BY	APPROVED BY

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

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ENGG. DIV./QA&

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## ANNEXURE-III

## 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

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Engg. Div. / QA&I

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ANNEXURE-IV

		Project : Stage : Package : Contractor : Contractor No. :		<b>STATUS OF ITEM REQUIRING QP&amp; SUB-SUPPLIER APPROVAL</b>						DOC. NO.: REV. NO.: DATE : PAGE : OF		
S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of submissio n	Date of comm t Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approva l Status	Sub-supplier detail submissio n schedule	Remarks	
<b>FORMAT</b>				1/1				Engg. Div. / QA&I				

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ANNEXURE-V

		Project		Stage :		FIELD WELDING SCHEDULE (To be raised by the contractor)							DOC. NO.:				
Contractor						Welding Code: .....							REV. NO.:				
Contractor No.													DATE :				
System													PAGE : OF				
Sl. No.	DRG No. for Weld Location and Identification mark	Descripti on of parts to welded	Matl. Spec.	Dimensio ns		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.		
<b>NOTES:</b>																	
<b>SIGNATURE</b>																	
FORMAT				1/1							Engg. Div. / QA&I						

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)				
	S.No	Description of Drgs/Docs	No of Prints	No of ROMs/DVDs/Portable Hard Disk	CD
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			
	i)	First Submission	1	1	
5		Commissioning and Performance Test Procedure manual			
	i)	First Submission	1 set	--	
	ii)	Final Submission (Directly to site)	4 sets	2	

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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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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	ANNEXURE-VII		

PRODUCT	AREAS OF TRAINING REQUIEMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
<b>FGD</b>	<p>Layout &amp; model of FGD area, cable &amp; piping trestles etc.</p> <p><b>FGD</b></p> <ul style="list-style-type: none"> <li>• Mass balance, Design, selection and sizing calculations of FGD</li> <li>• Training on factors affecting sizing/ efficiency of FGD system, equipments &amp; auxiliaries</li> <li>• Materials for FGD &amp; selection</li> <li>• Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc..</li> <li>• FGD electrical system</li> <li>• FGD control system</li> </ul> <p>Erection strategies, erection procedures</p> <p>Performance as per applicable code and demonstration tests.</p>	<p>Familiarization with various system and equipment</p> <p>Performance, data collection analysis and review</p> <p>O&amp;M feed back</p> <p>Operation history of various equipments and system</p> <p>Failure analysis</p>	<p>Manufacturing process of Absorber and equipments</p> <p>Welding process</p> <p>Testing facilities</p> <p>Product development in process</p> <p>Future plan for technology induction</p> <p>R&amp;D work in progress</p>	<p>Control philosophy operation, notices, logic &amp; protection schemes, O&amp;M manual familiarization O&amp;M issues.</p> <p>Familiarization of special maintenance techniques</p> <p>Special tool and tackles familiarization</p>
<b>MANMONTH</b>	<b>2</b>	<b>0.5</b>	<b>0.5</b>	<b>6</b>
<b>ZLD System</b> (In Projects where ZLD System is provided by Contractor)	<ul style="list-style-type: none"> <li>• Basic design features of ZLD system for FGD WWT Plant</li> <li>• Theory &amp; principle of operation</li> <li>• Discussions on various measurement points, Types, Ranges and locations for the offered system</li> <li>• Latest technological trends in ZLD system for FGD WWT Plant and design aspects</li> <li>• Software and model test</li> </ul>	Operational feedback O&M history/ problems related to ZLD system	<p>Training on ZLD system for FGD Waste water</p> <p>System description, basic design and engineering</p> <p>Manufacturing process of ZLD system equipments</p> <p>Testing facilities</p>	<p>Trouble shooting and fault analysis</p> <p>Familiarization of special maintenance techniques</p> <p>Special tool and tackles familiarization</p>
<b>MANMONTH</b>	<b>0.5</b>	<b>0.25</b>	<b>0.25</b>	<b>1</b>

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