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25.12.00 25.12.01	e) Various response times, having serious implication on operation & maintenance philosophy. f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load. g) Connectivity of Switchgear DDCMIS with Switchgear Relay Network. The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer. If any of the envisaged tests have been carried out by Bidder in a previous NTPC project, then the same need not be specifically conducted by the Bidder for this project, provided it is clearly established by the Bidder & accepted by the Employer that there is no difference between the system offered for this project & the previous NTPC project with respect to the test. However, even in such a case, test report of the previous project shall be submitted by the Bidder as a part of MDFT (Major Design Feature Test) test report. DEMONSTRATION OF APPLICATION ENGINEERING		
	Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following. (i) Logics/Loops: a) Drive logics implementation for each type of binary drive along with its display in HMI. b) Sequence implementation along with its display in HMI. c) Single non-cascade controller implementation. d) Cascade loop implementation. e) Master slave implementation with different slave combination. f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable. (ii) HMI Functions: a) LVS Annunciation. b) Graphics.		
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25.12.02	c) HSR d) Logs/Reports. e) Calculations (Basic & Performance Calculations). The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings. After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.			
25.12.03	During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.			
26.00.00	PRE-COMMISSIONING AND COMMISSIONING FACILITIES			
26.01.00	(a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications. (b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant. (c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six			
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	months prior to the respective implementations. The Employer will approve final verification of cleanliness. (d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period. (e) The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by Employer. (f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.			
26.01.00	Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain: (1.) Biodata including experience of the Commissioning Engineers. (2.) Role and responsibilities of the Commissioning Organisation members. (3.) Expected duration of posting of the above Commissioning Engineers at site.			
26.02.00	Initial Operation (a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests. (b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the contractor shall conduct the trial run as per clause 26.05.00 to demonstrate the compliance to the requirements as stipulated in the CERC (Indian Electricity Grid Code) Regulations, 2023. 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.			
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26.05.00	Trial Run: Trial run shall be conducted during the initial operation of the unit(s). Definition and provisions related to “trial run” shall be governed by CERC (Indian Electricity Grid Code) Regulations, 2023. a. Contractor shall demonstrate the following as per the requirements of CERC (Indian Electricity Grid Code) Regulations, 2023: i) Operation at a load of fifty-five (55) percent of MCR as per the CEA Technical Standards for Construction for a sustained period of four (4) hours. ii) Ramp-up from fifty-five (55) percent of MCR to MCR at a ramp rate of at least one (1) percent of MCR per minute, in one step or two steps (with stabilization period of 30 minutes between two steps), and sustained operation at MCR for one (1) hour. iii) Demonstrate overload capability with the valve wide open as per the CEA Technical Standards for Construction and sustained operation at that level for atleast five (5) minutes. iv) Ramp-down from MCR to fifty-five (55) percent of MCR at a ramp rate of at least one (1) percent of MCR per minute, in one or two steps (with stabilization period of 30 minutes between two steps). v) Primary response through injecting a frequency test signal with a step change of ± 0.1 Hz at 55%, 60%, 75% and 100% load. Provision of injecting external frequency test signal in control system for primary frequency response testing shall be in the contractor’s scope. vi) Reactive power capability as per the generator capability curve as provided by OEM considering over-excitation and under-excitation limiter settings and prevailing grid condition. These are the minimum test to be carried out as per the Indian Electricity Grid Code Regulations, 2023. Any other relevant clauses related to system performance or tests specified elsewhere in the specifications shall also be applicable. b. The contractor shall demonstrate the continuous operation capability of the Unit(s) at MCR as per regulations 22 of CERC (Indian Electricity Grid Code) Regulations, 2023.			
27.00.00	TAKING OVER Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be 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.			
28.00.00	TRAINING OF EMPLOYER'S PERSONNEL			
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28.01.00	The scope of service under training of Employer's engineers shall include a training module covering the areas of Operation & Maintenance. Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Employer: (a) Training for Steam Generator & ESP Equipment, TG & Auxiliaries and related equipments. (b) Training for Electric Systems including VFD and Electric power supply system. (c) Training for other SG/TG related C&I systems/equipments including training on Flame Monitoring System, Furnace and Flame Viewing System , Turbine Supervisory System (TSS) including vibration analyzer, vibration monitoring system axial shift, eccentricity measurements etc. for Main Turbine, BFP Turbine etc. Burner management study, control loop study, misc. system for SG C&I, EHTC, Turbine stress control system, Turbine protection system, ATRS, instrumentation etc. - c1: Training on Engineering, Model building,pre-testing, Post -test fine tuning of Advance process control systems with faculty having experience of atleast 5 years in Model Process Control. (d) Training for special packages specified elsewhere in Technical Specification, Section-VI. (e) Training for various C&I systems/equipment supplied includes the following: i) DDCMIS - Human Machine Interface – Hardware & Operating System ii) DDCMIS-Human Machine Interface System Engineering & Application Software. iii) DDCMIS – Control System Hardware and Control system Application Software. iv) DDCMIS – Operator Training : Use of the system at Works + at site. v) DDCMIS – Specialized Network security. (f) Training for power cycle piping/critical piping. (g) Training for UPS systems Annunciation system, SWAS, PA system, flue gas analyzers, CCTV and 24 VDC system. (h) Training on following aspects of fieldbus (i) Hardware & Software features (ii) System design, diagnostic and testing (iii) maintenance, troubleshooting and fault analysis.		
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	(i) Training on Non-Intrusive hardwired Electric Actuator and Fieldbus based Electric Actuator along with detail training on Foundation Fieldbus/ Profibus interface used in actuator (k) Training for numerical relays & networking systems supplied under MV & LT switchgear system. (l) Training courses on offered PLC system in the following areas: (a.) Operator training (b.) Hardware Maintenance training (c.) Software training (d.) Any other specialized training as required for system operation and maintenance.		
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28.03.00	The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering entire scope for the package. This shall cover all disciplines viz, Mechanical, Electrical, C&I , QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design software 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.			
28.04.00	Contractor shall also arrange for training of Employer's personnel in respect of fire detection and protection systems and other Balance of Plant equipments.			
28.05.00	Contractor shall provide training on application of PAUT (Phased array ultrasonic testing) and TOFD (Time of flight diffraction) techniques for two weeks (at least 80 Hours). The training shall be arranged at least six months prior to the start of erection works of SG & TG works.			
28.06.00	Exact details, extent of training and the training schedule shall be finalized based on the Bidder's proposal within two (2) months from placement of award.			
28.07.00	In all the above cases, the lodging and boarding of the Employer's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.			
28.08.00	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. Note: 1. For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person. 2. The total man months in each area shall be divided into suitable number of modules which shall be discussed and finalized during post award stage. 3. Duration of each module shall not be less than 10 (ten) working days out of which 20 % shall be for plant/manufacturers' works visits and 80% shall be classroom training. 4. A) Location of classroom training for engineering shall be at Design/Engineering office. B) Classroom training for erection/O&M shall be at location of Manufacturers' works.			
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28.09.00	TRAINING REQUIRED IN MAN MONTH			
	Area	Engineering (Man months)	Erection (Man months)	O&M (Man months)
	Steam Turbine Generator and its Auxiliaries	5.5	8.0	21
	Steam Generator and its Auxiliaries	5.5	8.0	20.5
	Station C&I (Control and Instrumentation)	3.5	5.5	10
	Ash Handling Plant	2.0	3.0	5.0
	Coal Handling Plant	1.0	1.5	2.5
	UF Membranes, RO Membranes, ZLD, Chlorine Di Oxide (ClO2) generation & dosing system, Condensate Polishing Plant (CPU), CW Treatment System	0.2	0.3	0.5
	Electrical systems consisting of generators, Excitation systems, VFD, Motors, MV/LV switchgears, relays, SAS and Switchyard	4.5	3.5	9
	Total	22.2	29.8	68.5
29.00.00	SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION			
	In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover: i) Working platforms should be fenced and shall have means of access. ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.			
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30.00.00	NOISE LEVEL The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) meter 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 except for i) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA. ii) Regulating drain valves in which case it shall be limited to 90 dBA-115 dBA. iii) Mill noise which will be limited to 85-90 dBA. iv) TG unit in which case it shall not exceed 90 dBA. v) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 90 dBA. vi) For BFP Motor Noise level shall be within the limit of 90 dBA.		
31.00.00	PACKAGING, TRANSPORTATION AND STORAGE 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 at site due to improper packing and preservation. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation. In addition to above, the contractor shall take all necessary measures for storage of all electronic equipment / systems at site in a dust free Air conditioned space ensuring proper temperature & humidity.		
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32.00.00	ELECTRICAL EQUIPMENTS/ENCLOSURES			
32.01.00	All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.			
33.00.00	INSTRUMENTATION AND CONTROL			
	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.			
33.01.00	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.			
	All scales and charts shall be calibrated and printed in Metric Units as follows:			
	1. Temperature	-	Degree centigrade (deg C)	
	2. Pressure	-	Kilograms per square centimetre (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.	
	3. Draught	-	Millimetres of water column (mm wc).	
	4. Vacuum	-	Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).	
	5. Flow (Gas)	-	Tonnes/ hour	
	6. Flow (Steam)	-	Tonnes/ hour	
	7. Flow (Liquid)	-	Tonnes / hour	
	8. Flow base	-	760 mm Hg. 15 deg.C	
	9. Density	-	Grams per cubic centimetre.	
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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.		
34.00.00	ELECTRICAL NOISE CONTROL The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).		
35.00.00	SURGE PROTECTION FOR SOLID STATE EQUIPMENT All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates, etc. shall be submitted by the Bidder.		
36.00.00	INSTRUMENT AIR SYSTEM The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.		
37.00.00	TAPPING POINTS FOR MEASUREMENTS Tapping points shall include probes, wherever applicable, for analytical measurements and sampling. For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.		
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38.00.00	i) Temperature test pockets with stub and thermowell ii) Pressure test pockets			
	SYSTEM DOCUMENTATION The Bidder shall provide drawings, system overview & description, hardware/software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C&I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification. The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.			
	38.01.00 Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.			
	39.00.00 MAINTENANCE MANUALS OF ELECTRONIC MODULES The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc. as required to do the testing and maintenance of the electronic modules. Backup & Restoration Procedures of DDCMIS, Station LAN & Advance Process Control shall be provided.			
40.00.00	MAKE IN INDIA REQUIREMENTS a) The bidder shall follow Indian laws, regulations and standards. There shall not be any restriction in terms of compliance to codes & standards of foreign origin only. The compliance to equivalent/better Indian as well as other codes & standards, wherever available, shall also be acceptable.			
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b)	The technologies/ products offered shall be environmentally friendly, consuming less energy, and safe, energy efficient, durable and long lasting under the prescribed operational conditions.			
c)	The bidder/its sub vendor/supplier shall ensure supply of spares, materials and technological support for the entire life of the project.			
d)	The bidder shall list out the products and components producing Toxic E-waste and other waste as specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled/ disposed of by the contractor and for this, the bidder has to establish recycling/disposal unit as specified. Bidder shall also comply with Plastic Waste Management Rules, 2016, as amended from time to time, and facilitate EPR (Extended Producer Responsibility) registration of Employer before import of plastic packaging product or products with plastic packaging or carry bags or multi-layered packaging or plastic sheets or like.			
e)	The equipment/ material sourced from foreign companies will be tested in accredited labs in India before acceptance wherever such facilities are available. The testing shall be carried out in accordance with MOP extant order/guidelines.			
f)	The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.			
g)	All applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.			
h)	Wherever required, the foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of Employer.			
i)	To protect the security, integrity and reliability of equipment in this package, it is essential to remove vulnerabilities arising out of the possibility of cyber-attack through malware/ Trojans etc. embedded in imported equipments. This requirement shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in this package. Contractor shall comply all the requirements of Order No 25-11/6/2018-PG, dated 02/07/2020 (attached as Appendix-I), issued by Ministry of Power, Government of India and its subsequent amendments/revisions. Contractor shall furnish declaration of compliance of MOP order dated 02/07/2020 requirements with dispatch of equipment/ item. Further, Contractor shall furnish back up testing certificates, whenever Employer asks the same.			
j)	All equipment/materials/parts/items required in this package which are domestically manufactured with sufficient domestic capacity as identified in Annexure-I of MOP order dated 16/11/2021 including its subsequent revisions (copy attached as Appendix-II) shall necessarily be sourced from the class-I local suppliers only as per the extant provisions of the Public Procurement (Preference to Make in India) Orders issued by DPIIT and MoP.			
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	Any violation w.r.t Make in India and minimum local content (MLC) requirements as specified shall be sole responsibility of the Bidder.			
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Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
183	Fire tenders	60
184	Portable fire-extinguishers	60
185	Cranes, EOT cranes, gantry crane & chain pulley blocks etc.	60
186	Elevator	60

(E) Minimum Local Content percentages in Engineering, Procurement & Construction (EPC) / Turnkey project

In case the contract is awarded through the EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local supplier. In addition, MLC for complete EPC project may also be prescribed as below:

	(1) Package Based Works	Minimum Local Content (%)
1	Boiler	60
2	TG System (Water Cooled Condenser)	60
3	Ash Handling Plant	60
4	Coal Handling Plant	60
5	Electro-static Precipitator (ESP)	60
6	Circulating Water (CW) System	60
7	Cooling Tower	60
8	Water Treatment System	60
9	Air Conditioning System (below 500TR)	60
10	Flue Gas Desulphurisation (FGD) System	60
11	Station Control & Instrumentation (C&I)	50
12	Hydro Power Projects (Electro-Mechanical Works)	60
	Gas based generation	
	Overall Gas Turbine Package (on finished Product basis)	
13	< 44 MW	60
14	44 –145 MW	50
	Overall Combined Cycle Gas Turbine (CCGT) Package (on finished Product basis)	
15	< 44 MW	60
16	44 – 145 MW	60
17	> 150 MW	60
	(2) Project as a whole	
1	Works and service contracts in Power Sector	60
2	Transmission Line with Conventional conductors (ACSR, AAAC, AL-59 etc.)	60
3	Transmission Line with High temperature Low Sag (HTLS) conductors	60
4	HVAC Substation Air Insulated (AIS)	60
5	HVAC Substation Gas Insulated (GIS)	60
6	HVDC Substation	60
7	Distribution Sector	60

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	Annexure-II General guidelines to be adopted selectively in an appropriate manner by the procuring entities in their tender documents. 1. The bidder shall have to be an entity registered in India in accordance with law. 2. The bids shall be in the language as prescribed by the tenderer/procurer. 3. The bids shall be in Indian Rupees (INR) (in respect of local content only). 4. Indian subsidiaries of foreign bidders shall have to meet the qualifying criteria in terms of capability, competency, financial position, past performance etc. 5. The bidder shall follow Indian laws, regulations and standards. 6. To be eligible for participation in the bid, foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India as may be specified by the tenderer/ procurer. 7. Similar or better technology than the technology offered in respect of material, equipment and process involved shall be transferred to India. Along with the transfer of technology, adequate training in the respective field shall also be provided. 8. Country of origin of the equipment/material shall be provided in the bid. 9. For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for more than _____ years (to be specified by the procurer). 10. The technologies/ products offered shall be environmental friendly, consuming less energy, safe, energy efficient, durable and long lasting under the prescribed operational conditions. 11. The supplier shall ensure supply of spares, materials and technological support for the entire life of the project. 12. The manufacturers/ supplier shall list out the products and components producing Toxic E-waste and other waste as may be specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ supplier and for this, the Manufacturer/supplier along with procurer has to establish recycling / disposal unit or as may be specified. 13. Minimum Local Content requirement for goods, services or works shall be in accordance with the conditions laid down in respective Order(s) of the sectors on Public Procurement (Preference to Make in India) to provide for purchase preference (linked with local content).		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 79 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	14. The equipment/ material sourced from foreign companies may be tested in accredited labs in India before acceptance wherever such facilities are available. 15. The Tender fee and the Bank Guarantee (BG) shall be in Indian Rupees only. 16. The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect. 17. Applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier. 18. Statutory laws/regulations including the labour and environmental laws shall be strictly complied with during supply, storage, erection, commissioning and operation process. A regular compliance report shall be submitted to the procurer/appropriate Authorities. 19. Formation of new joint venture in India shall be permitted only with the Indian companies. 20. Tendering by the agent shall not be accepted. 21. In case local testing is not considered necessary by the procurer, the original test report in the language prescribed by the procurer may be accepted. The translated test report shall not be accepted unless it is notarised. 22. Certification/compliance as per the Indian Standards/ International Standards/ Indian Regulations/ specified Standards shall be mandatory, where ever applicable. 23. Quality assurance of the product shall be carried out by the procurer or an independent third party agency appointed by the procurer. Manufacturing Quality Plan as approved by the procurer shall be followed by the manufacturer/supplier. 24. Wherever required by the procurer, foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of utilities. 25. Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 80 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	LIST OF CODES AND STANDARDS			
	Indian Standards	Title	International and Internationally recognised standards	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 81 OF 119

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 monocry-stallines semiconductor rectifier cells and stacks		
	IS:3963	Roof extractor unit		
	IS:3975	Mild steel wires, strips and tapes for armouring cables		
	IS:4503	Shell and tube type heat Exchanger		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 83 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers. ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors. ARI-450-6 Standard for water cooled refrigerant condensers. ARI-550 Standard for centrifugal water chilling packages. ARI-410 Standard for forced circulation air cooling and air heating coils ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 (Part-1,2) Fans BS:400 Low carbon steel cylinders for the storage & transport of permanent gases. BS:401 Low carbon steel cylinders for the storage & transport of liquified gases. CTI Code Acceptance test code for Water Cooling Tower. ACT-105 ANSI-31.5 Refrigerant piping ASME-PTC- Atmospheric Water Cooling Equipment 23-1958 AMCA A-21C Test Code for air moving devices API:618 Reciprocating Compressor for general refinery services. HYDRAULIC INSTITUTE STANDARDS. HYDRANT SYSTEM MANUALS OF TAC. TAC MANUALS OF SPRAY SYSTEM NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS. INDIAN EXPLOSIVES ACT. INDIAN FACTORIES ACT. STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 85 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents. Temperature Measurements - Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). - Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. - Temperature measurement by electrical Resistance thermometers - IS:2806. - Thermometer - element - Platinum resistance - IS:2848. Pressure Measurements - Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). - Electronic transmitters BS:6447. - Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. - Process operated switch devices (Pr. Switch) BS-6134. Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software - Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. - Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. - Compatibility of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. - Dynamic response testing of process control instrumentation ISA - S 26 (1968).		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. 6. Printed circuit boards - IPC TM - 650, IEC 326 C. 7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. 8. Edge socket connectors - IEC 130-11. 9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. 10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). 11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R). 12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. 13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. 14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. 15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988. 16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Instrument Switches and Contact - Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. - Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures - Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). - Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). - Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area - Classification of hazardous area - NFPA 70 - 1984, Article 500. - Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. - Intrinsically safe apparatus - NFPA 493 1978. - Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. - Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977. Sampling System - Stainless steel material of tubing and valves for sampling system - ASTM 296-82, Grade 7 P 316. - Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. - Water and steam in power cycle - ASME PTC 19.11. - Standard methods of sampling system - ASTM D 1066-99. Annunciators - Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. - 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 - Damp heat cycling test - IS:2106		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	Process Connection & Piping - Codes for pressure piping "power piping" - ANSI B 31.1. - Seamless carbon steel pipe ASTM - A - 106. - Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. - Material for socket welded fittings - ASTM - A - 105. - Seamless ferritic alloy steep pipe - ASTM - A - 335. - Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. - Composition bronze of ounce metal castings - ASTM - B - 62. - Seamless Copper tube, bright annealed - ASTM - B - 168. - Seamless copper tube - ASTM - B - 75. - Dimension of fittings - ANSI - B - 16.11. - Valves flanged and butt welding ends - ANSI - B - 16.34. Instrument Tubing - Seamless carbon steel pipe - ASTM - A 106. - Material of socketweld fittings - ASTM - A105. - Dimensions of fittings - ANSI - B - 16.11. - Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1. Cables - Thermocouples extension wires/cables - ANSI MC 96.1 - 1992. - Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815. - Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83. - Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). - Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. - Rules for Testing insulated cables and flexible cables : VVDE - 0472 - Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81. 9. Oxygen index and temperature index test - ASTM D - 2863. 10. Smoke density measurement test - ASTM D - 2843. 11. Acid gas generation test - IEC - 754 - 1. 12. Swedish Chimney test - SEN - 4241475 (F3). 13. Teflon (FEP) insulation & sheath test - ASTM D - 2116. 14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784. 15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I). Cable Trays, Conduits 1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984. 2. -do- Test Standards. NEMA VE-1-1979. 3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTM A - 386-78. Public Address System 1. Specifications for loud speakers - IS:7741 (Part-I, II and III) 2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301 3. Specification for Public Address Amplifiers - IS:10426. 4. Code of practice for outdoor installation of PA system - IS:1982. 5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. 6. Basic environmental testing procedures for electronic and electrical items - IS:9000. 7. Characteristics and methods of measurements for sound system equipment - IS:9302 8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 109 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) 10. Fittings for rigid steel conduits for electrical wiring - IS:2667 11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System 1. API 670 - 1994 2. BS : 4675 Part-2			
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ANNEXURE-III

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

LEGENDS

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

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

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

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

QP/INSPN CATEGORY:

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

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

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

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

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

1/1

Engg. Div. / QA&I

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ANNEXURE-IV

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

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	CORPORATE QUALITY ASSURANCE/ कॉरपोरेट गुणवत्ता आश्वासन MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट ANNEXURE-VII	

Ref No: संदर्भ सं.:		Date: तिथि:	
i.	Main Contractor मुख्य संविदाकार		
ii.	Project परियोजना		
iii.	Package Name पैकेज का नाम	Package No पैकेज सं.	
iv.	Proposed Item/Scope of Sub-contracting उप-संविदा(अनुबंध) का प्रस्तावित मद/ दायरा		
v.	Item covered under निम्नलिखित के अंतर्गत शामिल मद	Schedule-1 /अनुसूची- 1	As per contract clause No- अनुबंध के अनुसार खंड सं.-- -
		Schedule-2 अनुसूची- -2	
vi.	If item is Schedule-1 and proposed sub-vendor is indigenous, Main Contractor to explain how the contractual provisions will be fulfilled /यदि मद अनुसूची -1 है और प्रस्तावित उप-विक्रेता स्वदेशी है, तो मुख्य संविदाकार को स्पष्ट करना होगा कि संविदा/अनुबंध के प्रावधान कैसे पूरे किए जाएंगे		
vii.	Name and Address of the proposed Sub-vendor's works /प्रस्तावित सब-वेंडर का नाम तथा पता		
viii.	PO placement date/ Start of manufacturing (if self-manufactured) as per L2 network पीओ नियोजन की तिथि / एल- 2 नेटवर्क के अनुसार विनिर्माण (यदि स्व-निर्मित है) की शुरुआत		
ix.	Item Description (Type/Size/Rating/Scope of Sub-Contracting) मद का विवरण (प्रकार / आकार / रेटिंग / उप-अनुबंध का दायरा)	Total quantity of proposed item envisaged in this package (Nos/ Running Meters/ Kgs/ Tons etc) इस पैकेज में परिकल्पित प्रस्तावित मद की कुल मात्रा (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि)	Quantity proposed to be procured from proposed sub-vendor (Nos/ Running Meters /Kgs /Tons etc) प्रस्तावित उप-विक्रेता (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि) से खरीदी जाने वाली मात्रा
			Timeline for quantity requirements as per project schedule & whether the proposed Sub-vendor equipped with adequate capacity to supply proposed order quantity in time / परियोजना समय सूची के अनुसार मात्रा आवश्यकताओं के लिए समय-सीमा और क्या प्रस्तावित उप-विक्रेता समय पर प्रस्तावित मांग की मात्रा की आपूर्ति करने में पूरी तरह से सक्षम है
x.	Supply experience of the proposed sub-vendor (including supplies to Main Contractor, if any) for similar item/scope of sub-contracting, for last 3 years (Note:- Only relevant experience details w.r.t. proposed item/scope of subcontracting to be brought out here) पिछले 3 वर्षों के लिए उप-अनुबंध के समान मद / दायरे के लिए प्रस्तावित सब-वेंडर (मुख्य संविदाकार हेतु		

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन					
	MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT					
	मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट ANNEXURE-VII					

आपूर्ति, यदि कोई हो, सहित) का आपूर्ति अनुभव (नोट: - उप-अनुबंध के प्रस्तावित मद / दायरे के संबंध में केवल प्रासंगिक अनुभव के विवरण का उल्लेख हो											
Project/Package परियोजना/पैकेज		Customer Name ग्राहक का नाम		Supplied Item (Type/Rating/Model /Capacity/Size etc) आपूर्ति मद (प्रकार/रेटिंग /मॉडल /क्षमता/आकार आदि)		PO ref no/date पीओ संदर्भ सं. /तिथि		Supplied Quantity आपूर्ति की मात्रा		Date of Supply आपूर्ति की तिथि	
We confirm that as per our physical assessment, the proposed sub-vendor has requisite capabilities & supply experience and is suitable for supplying the proposed item/scope of sub-contracting/हम अपने भौतिक आकलन के अनुसार इस बात की पुष्टि करते हैं कि, प्रस्तावित उप-विक्रेता के पास अपेक्षित क्षमता और आपूर्ति करने का अनुभव है और उप-अनुबंध के दायरे /प्रस्तावित मद की आपूर्ति के लिए उपयुक्त है।											
Name: नाम:		Desig: पद:		Contact No: दूरभाष सं.:		Sign: हस्ताक्षर:		Date: तिथि:			

Company's Seal/Stamp:- कंपनी का मुहर:-



CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन
SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली

i.	Item/Scope of Sub-contracting उप-संविदा(अनुबंध) का मद/ दायरा		
ii.	Address of the registered office पंजीकृत कार्यालय का पता |		Details of Contact Person संपर्क व्यक्ति का विवरण (Name, Designation, Mobile, Email) (नाम, पदनाम, मोबाइल, ईमेल) |
iii.	Name and Address of the proposed Sub-vendor's works where item is being manufactured प्रस्तावित उप-विक्रेता के कार्यों का नाम और पता, जहां मद का निर्माण किया जा रहा है |		Details of Contact Person: संपर्क व्यक्ति का विवरण (Name, Designation, Mobile, Email) (नाम, पदनाम, मोबाइल, ईमेल) |
iv.	Annual Production Capacity for proposed item/scope of sub-contracting उप-संविदा(अनुबंध) के प्रस्तावित मद / दायरे के लिए वार्षिक उत्पादन क्षमता		
v.	Annual production for last 3 years for proposed item/scope of sub-contracting उप-संविदा(अनुबंध) के प्रस्तावित मद / दायरे के लिए पिछले 3 वर्षों का वार्षिक उत्पादन		
vi.	Details of proposed works प्रस्तावित कार्यों का विवरण		
1.	Year of establishment of present works वर्तमान फैक्टरी की स्थापना का वर्ष		
2.	Year of commencement of manufacturing at above works उपरोक्त फैक्टरी में निर्माण कार्य शुरू होने का वर्ष		
3.	Details of change in Works address in past (if any) पूर्व में फैक्टरी स्थल में परिवर्तन का विवरण (यदि कोई हो)		
4.	Total Area कुल क्षेत्र		
	Covered Area शामिल क्षेत्र		
5.	Factory Registration Certificate फैक्टरी पंजीकरण प्रमाण पत्र		Details attached at Annexure – F2.1 विवरण अनुलग्नक- एफ 2.1 पर संलग्न है
6.	Design/ Research & development set-up डिजाइन / अनुसंधान और विकास सेटअप (No. of manpower, their qualification, machines & tools employed etc.) (श्रमिकों की संख्या, उनकी योग्यता, मशीन और उपलब्ध उपकरण आदि)		Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design Details attached at Annexure – F2.2 (if applicable) लागू / लागू नहीं, अगर विनिर्माण मुख्य संविदाकार / खरीददार के डिजाइन के अनुसार है) विवरण अनुलग्नक –एफ 2.2 पर संलग्न है। (यदि लागू हो)
7.	Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc) मैनपावर विवरण के साथ समग्र संगठन का चार्ट(डिजाइन / विनिर्माण / गुणवत्ता आदि)		Details attached at Annexure – F2.3 विवरण अनुलग्नक – F2.3 में संलग्न है।
8.	After sales service set up in India, in case of foreign sub-vendor(Location, Contact Person, Contact details etc.) भारत		Applicable / Not applicable लागू / लागू नहीं

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	में विक्री सेवा की स्थापना के बाद, विदेशी उप-विक्रेता के मामले में(स्थल , संपर्क व्यक्ति, संपर्क विवरण आदि)	<i>Details attached at Annexure – F2.4</i> विवरण अनुलग्नक -2.4 पर संलग्न है।			
9.	<i>Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any</i> फ्लोचार्ट सहित विनिर्माण प्रक्रिया निष्पादन योजना , जिसमें आउटसोर्स प्रक्रिया, यदि कोई हो, सहित कच्चे माल से तैयार उत्पाद तक विनिर्माण के विभिन्न चरणों को दर्शाया गया हो,	<i>Details attached at Annexure – F2.5</i> विवरण अनुलग्नक - F2.5में संलग्न है।			
10.	<i>Sources of Raw Material/Major Bought Out Item</i> कच्चे माल के स्रोत / खरीदे हुए मुख्य मद	<i>Details attached at Annexure – F2.6</i> विवरण अनुलग्नक - F2.6में संलग्न है।			
11.	<i>Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing</i> कच्चे माल / खरीदे हुए मद, प्रक्रियाबद्ध, अंतिम परीक्षण, पैकिंग करते समय गुणवत्ता नियंत्रण	<i>Details attached at Annexure – F2.7</i> विवरण अनुलग्नक - F2.7 पर संलग्न है			
12.	<i>Manufacturing facilities (List of machines, special process facilities, material handling etc.)</i> विनिर्माण सुविधा(मशीनों की सूची , विशेष प्रक्रिया सुविधाएं, सामग्री रख-रखाव आदि)	<i>Details attached at Annexure – F2.8</i> विवरण अनुलग्नक - F2.8में संलग्न है।			
13.	<i>Testing facilities (List of testing equipment)</i> परीक्षण सुविधाएं(परीक्षण उपकरण की सूची)	<i>Details attached at Annexure – F2.9</i> विवरण अनुलग्नक – F2. 9 में संलग्न है।			
14.	<i>If manufacturing process involves fabrication then-</i> यदि निर्माण प्रक्रिया में फेब्रिकेशन की गई है तो- <i>List of qualified Welders</i> पात्र वेल्डर की सूची <i>List of qualified NDT personnel with area of specialization</i> विशेषज्ञता के क्षेत्र सहित पात्र एनडीटी कार्मिकों की सूची	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure – F2.10</i> विवरण अनुलग्नक - F2.10में संलग्न है। <i>(if applicable)</i> लागू / लागू नहीं			
15.	<i>List of out-sourced manufacturing processes with Sub-Vendors' names & addresses</i> सब-वेंडर द्वारा बाह्य स्रोतों (उनके नाम और पते सहित)से करवाएं गए निर्माण प्रक्रियाओं की सूची	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure. –F2.11</i> विवरण अनुलग्नक - F2.10में संलग्न है। <i>(if applicable)</i> (यदि लागू हो)			
16.	<i>Supply reference list including recent supplies</i> नवीनतम आपूर्ति सहित आपूर्ति संदर्भ सूची	<i>Details attached at Annexure – F2.12</i> विवरण अनुलग्नक - F2.12 में संलग्न है। <i>(as per format given below)</i> (नीचे दिए गए प्रारूप के अनुसार)			
<i>Project/ package परियोजना /पैकेज</i>	<i>Customer Name ग्राहक का नाम</i>	<i>Supplied Item (Type/Rating/Model /Capacity/Size etc) आपूर्ति की गई वस्तु (प्रकार / रेटिंग / मॉडल / क्षमता / आकार आदि)</i>	<i>PO ref no/date पीओ संदर्भ सं. / तिथि</i>	<i>Supplied Quantity आपूर्ति की मात्रा</i>	<i>Date of Supply आपूर्ति की तारीख</i>
17.	<i>Product satisfactory performance feedback letter/certificates/End User Feedback</i> उत्पाद के संतोषजनक प्रदर्शन संबंधी फीडबैक पत्र / प्रमाण पत्र / अंतिम उपयोगकर्ता फीडबैक			<i>Attached at annexure - F2.13</i> अनुलग्नक F2. 3पर संलग्न है	
18.	<i>Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product</i>			<i>Applicable / Not applicable</i> लागू / लागू नहीं	

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	(similar or higher rating) प्रस्तावित उत्पाद (एक समान या उच्च रेटिंग वाले) के लिए टाइप टेस्ट रिपोर्ट (टाइप टेस्ट विवरण, रिपोर्ट संख्या, एजेंसी, जांच की तारीख) का सारांश नोट: - रिपोर्ट प्रस्तुत करने की आवश्यकता नहीं है <i>Note:- Reports need not to be submitted</i>	Details attached at Annexure – F2.14 विवरण अनुलग्नक - F2.1 4में संलग्न है (if applicable) (यदि लागू हो)			
19.	Statutory / mandatory certification for the proposed product प्रस्तावित उत्पाद के लिए वैधानिक / अनिवार्य प्रमाणीकरण	Applicable / Not applicable लागू / लागू नहीं Details attached at Annexure – F2.15 (if applicable) (यदि लागू हो)			
20.	Copy of ISO 9001 certificate आईएसओ 9001 प्रमाण पत्र की प्रति (if available(यदि उपलब्ध हो))	Attached at Annexure – F2.16 अनुलग्नक में संलग्न - F2.1 6 है			
21.	Product technical catalogues for proposed item (if available) प्रस्तावित मद के लिए उत्पाद तकनीकी कैटलॉग (यदि उपलब्ध हो)	Details attached at Annexure – F2.17 विवरण अनुलग्नक - F2.1 7 में संलग्न है			
Name:		Desig:		Sign:	
नाम:		पद:		हस्ता क्षर:	
Date:					
तिथि:					

Company's Seal/Stamp:- कंपनी की मुहर / मोहर: -

1.0 Sub-Contractors/ Sub-Vendors/ Sub-Suppliers:

- 1.1 Any sub-vendor (in addition to Indicative Vendor List E-60 part of bid document) suggested by bidder except the sub-vendor from land border sharing countries shall be treated under DR (Details Required) category, if required. But the number of sub-vendors in DR category shall be decided on mutually agreed basis during post award discussions. For the approval of any new sub-vendor, please refer clause no.22.17.00. For the proposal of sub-vendors from land border sharing countries, Bidder shall ensure the compliance of GOI circulars and shall submit such sub-vendor proposal to NTPC for review & acceptance. (Please refer GTR clause no 40.00.00). In addition to above, for certain System/ Items covered in Technical Specifications, where Sub-QR (Qualifying requirements) are specified, bidder shall confirm that firm purchase order to the Sub Vendors selected/ shortlisted by them for these items/ systems, will only be placed after acceptance by NTPC of the concerned Sub Vendors meeting the specified qualifying requirements.
- 1.2 For the proposals where status of proposal is in “DR” category (details required), as NTPC does not have any past experience with them) in the above mentioned list, Bidder shall furnish the complete details of such proposals, in NTPC Formats , in time bound manner, so as not to impede the progress of the Project/ Works. For details please refer clause no 22.17.00.
- 1.3. Bidder shall furnish the required details, as detailed out in 2.3 above, of the proposed Manufacturer/ Sub-Vendor, along with their own detailed recommendations, in the NTPC-formats. proposals/ details shall be received only up to 3 months prior to ordering date of the concerned item (L-2 Network/ BOI Schedule), for NTPC review and assessment. Bidder may accordingly plan the submissions.
- 1.4 Bidder to confirm that the list of Items/ BOI includes all major Items/ BOIs required in their scope of work/ supply. If any Item/ BOI is left out or gets included during detailed engineering, Bidder shall propose the Manufacturers/Sub-Vendors, prior to initiating the procurement action. In such cases also, proposals, with details given in 2.3 above, shall be forwarded in time bound manner, within time limits given in 2.1 & 2.4 above.
- 1.5 It is understood that in terms of provisions of Cl. 19.1 of GCC (General Conditions of Contract), in case bidder opts for additional Sub - Vendor proposals, over & above the indicative sub vendor list herein (part of bid document), may be given, within sufficient time, so as not to impede the progress of the work. Accordingly, all such proposals along with required details (as given in 2.3 above), shall be received only up to 3 months prior to ordering date of the concerned item/ Scheduled start of the Manufacture of Self Manufactured Item, for NTPC review and assessment.
- 1.6 It is agreed that wherever “Main Contractor approved Sources” have been mentioned in the Indicative Vendor List (part of bid document), Bidder shall submit to NTPC, the copies of unpriced Purchase Order, on the specific Manufacturer, from whom supply is intended to be made, to enable NTPC to plan for Surveillance Audit of the manufacturer, if desired, prior to issue of Dispatch Clearance of the concerned item.
- 1.7 Bidder has to furnish System Supplier proposals for various Sub-Systems which are termed as Level-I Vendors. Further, Manufacturer/ Sub-vendor proposals for major items/ components under these systems, are not yet furnished, as the same would

depend on Level-I vendor shortlisted by bidder for such systems. It is agreed that sub vendor proposals for such items/ components (Level-II vendors) shall be made by bidder to NTPC with complete sub vendor details, in such a manner that the proposals can be finalised after award of contract by bidder on Level-I Vendor. It is understood that schedule of such Sub-vendor proposals shall be in accordance with the Project schedule (L-2 Network/ BOI Schedule) taking into consideration the time required for processing sub vendor approvals, by NTPC, enumerated above.

- 1.8 In the Indicative Sub Vendor List (part of the bid document), against each Item/ Sub-Vendor, the Category of Inspection is also indicated. NTPC reserves the right to conduct Surveillance Inspection/ Audit of the material, which are identified in Cat-II/ Cat-III, to verify the effectiveness of Quality System of bidder and conformance of the offered lot, to the applicable Standards/ requirements.

2.0 Welding:

Bidder to ensure that they will submit to NTPC, their approved List of Make/ Brand of Electrodes/ Welding Consumables, to be used during welding at Site.

- 3.0 Bidder to ensure that for Schedule-I/ Schedule-II supplies, orders shall be placed suitably on approved Sub-Vendors' manufacturing location (Foreign/ Indigenous), keeping the Contractual requirements in view.
- 4.0 Bidder to ensure the requirements of QA Documentation as per GTR clause no.23.00.00 for its completeness and only thereafter submit to NTPC.
- 5.0 Bidder shall furnish duly filled, below mention QA coordination procedure (QACP) during post award.

QACP (QA Coordination Procedure)

1. SCOPE OF WORKS:

- a) **QUALITY ASSURANCE:** Review of main contractor's (and their proposed major sub-contractor's) detailed quality plan (MQP and FQP) including customer hold points for inspection. Review of manufacturer's test /inspection report and test certificates as per approved QP.
- b) **INSPECTION SERVICES:** Witness of stage and final shop inspection /verification of documentation/ performance testing of major equipment as per approved QP and issuance of CHP and MDCC.
- c) **VENDOR/SUB-VENDOR APPROVAL:** Review and approval of major sub-contractors proposed by the Contractor shall be done by Employer QA&I Finalization of inspection category of items being manufactured and supplied by Main Contractor and sub-vendors shall be done by Employer QA&I

2. SCOPE OF PROCEDURE:

- a) The scope of this procedure is to explain and elaborate the scope of work of quality assurance & inspection, during the execution of service between employer (QA & Regional Inspection Offices), and bidder for project
- b) Items not covered in Quality Plan are CAT-III items. Such items & items identified as Cat-III in vendor list, shall be treated as non-inspection items and Certificate of Conformance (COC) shall be submitted to employer (QA & Regional Inspection Offices) for review.

3. DOCUMENTATION TO BE PROVIDED BY bidder:

- a) Master list of items requiring QP and Type test approval: shall be prepared by main contractor and approved by Employer QA&I Approved Drawings, Data-sheet, Specifications, etc. shall be provided to Employer QA&I by bidder for inspection purpose.

4. SUBMISSION OF QUALITY PLAN FOR REVIEW, COMMENTS AND APPROVAL:

- a) Transmittal (In soft) shall indicate the following:
 - i. Name of the item/equipment & QP/Document Number as per master list.
 - ii. Remarks / Special notes along with reference documents and norms.
 - iii. QPs shall be submitted in the prescribed formats of Employer QA&I
- b) All correspondence and submission of Quality Plan, Field Quality Plan and other documents shall be submitted in soft form i.e. Adobe Acrobat file (pdf format) through Dreams 2.0 indicating the identical Name & Number of QP as per 'Master List of Documents' (MDL). Coordinator of Main Contractor shall arrange submission of Master list of QP documents (In Soft – Dreams 2.0) for various equipment, plant & systems to the Employer QA&I coordinator
- c) On review/ comments / approval of QP, QA&I Coordinator shall forward in PDF form (soft) only, to bidder's coordinator in two weeks.
- d) On review of each QP/document shall be categorized in one of the following:
 - i. Category-I Approved
 - ii. Category-II Approved subject to incorporation of comments and to be resubmitted after incorporation of comments.
 - iii. Category-III Disapproved. See comments.

- e) Considering the criticality of the project requirement, all out efforts shall be made to re-submit the QPs/documents as early as possible but not later than 2 (two) weeks from the date of receipt of commented QP/documents from Employer QA&I
- f) For MQPs and FQPs approved in Cat-II, the work can be proceeded subject to taking care of comments furnished on documents. However, these comments will be taken care of by Main Contractor while submitting the revised QP/documents for final approval in Cat-I along with their explanation, if any (highlighting all the changes).
- g) Final inspection & clearance shall only be issued on approved drawings, Data sheets & QP (in Category-I).

6. EMPLOYER QA&I PROGRESS REPORTING: Bidder's coordinator shall furnish on or before 12th of every calendar month progress report, highlighting QA&I activities in the reporting month, which shall contain the summary of QP/ documents submission and approval status for QP/ documents under approval to Employer QA&I Coordinators for information. Major QA&I hold-ups shall be highlighted in the progress report.

7. CUSTOMER CO-ORDINATION MEETING:

- a) To resolve and sort out various QA&I matters and outstanding issues structured contract co-ordination meeting (CCM) shall be held periodically as per notice of bidder /Employer QA&I
- b) Bidder may arrange for the participation of his sub-vendors also, if required for the meeting to resolve their respective issues.
- c) The venue for the meeting will be the office of Employer/Bidder as decided on case-to-case basis
- d) Minutes of Meeting (MOM) will be drafted by the agency at whose office the meeting is held and the same will be finalized and signed by all parties before close of the meeting.

8. CORRESPONDENCE:

- a) All correspondences related to this project shall be among coordinators of, QA&I & bidder as indicated in point no: 5.0.

- b) **EMPLOYER QA&I CONSULTANT's Regional Inspection Offices:** The list of Inspection Offices along with names and contact / communication details of the Heads of RIOs and the areas of their jurisdiction is placed at. <http://qains.ntpc.co.in/inspection/>

9. DEVIATION / NON-CONFORMITY DISPOSITIONING:

- a) If deviations are observed during inspection, same shall be recorded by Employer inspector in the CHP.
- b) Classification of deviations: It would be required to classify a particular deviation as Major or Minor, which shall be done by Employer QA&I applying following criteria:
- i) **MAJOR Non-conformities:** non-conformity is a "Major" non-conformity which prima-face is likely to have bearing on the Performance, Reliability, Safety, Interchangeability, Maintainability, Working life of the material, equipment or service.
- ii) **MINOR Non-conformities:** A non-conformity not categorized as 'Major' is considered as "Minor", i.e. deviation is with respect to the applicable drawings/applicable standards.

c) Dispositioning of Deviation / Non-Conformity:

i) MAJOR:

Any deviation is characterized as "Major", the bidder to submit a justification as to why the same can be accepted with due corrective and preventive action plan. Such justification shall be submitted to the employer/, enabling it (Employer QA&I) to comment on the bidder's justification/proposal for acceptance/rework.

ii) MINOR:

Dispositioning of MINOR deviations shall be done by employer QA&I

Complete details of bidder design dispositioning of the deviation shall be sent by bidder to employer QA&I for proceeding further. QA&I would review the bidder design's dispositioning and either proceed further with acceptance decision or return the dispositioning to bidder for reclassifying it as Major for dispositioning by the CQA.

Format for "Non- Conformity Report for Manufacturing & Inspection Stages" is attached at Annexure VIII.

- 10. Type Tests (wherever applicable as per specification or approved QPs / Drawings):** Bidder shall ensure that type tests (wherever applicable) are duly approved/accepted by NTPC Engg (Engg Consultant) before offering such item for inspection as per QP. Evidence of Type Test approval in such cases shall be furnished by bidder, while raising inspection call.

11. RESPONSIBILITY FOR ISSUING MDCC:

Employer QA&I shall issue MDCC in case of Cat-I and Cat-II items and for Cat-III items Employer QA&I shall issue MDCC directly based on COC of bidder. MDCC shall be issued after checking of vendor approval status, BBU approval, and Type Test (if applicable).

12. INSPECTION PROCEDURE: Inspection shall be carried out as detailed:

For Cat-I & II items: where physical inspection (Cat-I) and documents review (Cat-II) envisaged in approved QP by Employer QA&I:

a) INDIGENOUS SUPPLIES:

- For items under inspection Category Cat-I, the concerned Regional Inspection Office under whose jurisdiction the manufacturer is located. Inspecting Engineer or reviewing engineer (in case of waiver of presence of NTPC engineer) shall issue the MDCC/dispatch clearance.

- In case, only review of Vendor's inspection report / test certificates by NTPC has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be submitted to the concerned NTPC-RIO, in whose jurisdiction manufacturer is located.
- In case where QP has not been envisaged (inspection category III), all such materials shall be cleared on the basis of Certificate of Conformity (COC) in attached format from bidder, which shall be submitted concerned NTPC-RIO, in whose jurisdiction vendor (main contractor) is located.

b) FOREIGN SUPPLIES:

- For items (inspection Category Cat-I) directly dispatchable to site from foreign manufacturer, the MDCC/dispatch clearance shall be issued by NTPC's inspecting engineer. In case of waiver of presence of NTPC engineer or Cat-II/III, the MDCC shall be issued by CQA Engineer on satisfactory review of test/inspection reports.

For items to be brought to Bidder's works from foreign manufacturer, before final dispatch to site, MDCC shall be issued by relevant Resident Inspector/RIO after satisfactory activities at works and on review of CHP report of NTPC's Inspecting Engineer for inspection at foreign manufacturer's works or on verifying acceptance report of CQA, in case of waiver of presence of NTPC Engineer for inspection at foreign source.

NOTE:

- I. Material inspection by RIO-A at the works of sub-contractor in their respective jurisdiction and dispatched to the works of the other sub-contractor for assembly or otherwise in the jurisdiction of RIO-B before final dispatch to project site, shall be accorded dispatch clearance on a CHP clearance report by RIO-A and the CHP of the completed item / equipment will be issued by RIO-B.as per the approved BBU.
- II. In case, only review of Vendor's inspection report / test certificates by Employer QA&I has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be duly reviewed by employer (QA&I) for all documents as per approved QP
- III. In case of items where QP has not been envisaged at all (inspection category Cat-III), such material shall be cleared and MDCC shall be issued by Employer QA&I -RIO/CQA (for foreign supplies) on the basis of Certificate of Conformity.

13. DOCUMENTATIONS / INPUTS BY Bidder: Bidder shall ensure availability of duly approved documents / inputs (e.g. Drawings / Data-Sheets, / Type Test Procedures / Type Test Approvals, Quality Plan, Routine Test Procedures, Reference documents Codes, Standards, Specifications and Acceptance norms, etc.) at the place and time of inspection for reference of Inspection Engineers. Master list of Drawings, Datasheet, etc. shall also be made available.

- a) **THREE MONTHLY ROLLING INSPECTION PLAN :**To facilitate advance planning of inspection of supplies, in addition to giving inspection notice at identified *CHP stages as per approved QP, Main Contractor Coordinator shall furnish three monthly rolling inspection program every month, indicating schedule dates of inspection at identified CHP stages. Such a program shall be updated each month. Such program shall be confirmed by specific inspection calls in accordance with Clause 12.
- b) ***Definition of C.H.P.:** CHP "Customer Hold Point" ('W') is a stage identified by customer in Quality Plan, which is to be offered to customer or its authorized representative by the Vendors, Supplier / Sub-supplier Contractor for witnessing, verification or review, beyond

which work will not proceed without written consent of the Inspecting Authority. The report prepared by the Inspector is called "CHP Report".
Above three-monthly rolling inspections plan for Shop manufactured & BOIs shall be furnished directly to the respective Employer QA&I

- c) **INSPECTION AT PACKAGE CONTRACTOR'S SUB-SUPPLIER:** Bidder's coordinator shall ensure that unpriced purchase order for the identified BOI where in Employer QA&I Inspection is required, as per the approved Quality Plan, the unpriced Purchase Order shall be suitably tied-up with their suppliers so that the suppliers offer the identified equipment for Employer QA&I inspection for identified tests / checks. Purchase Order, with detailed Purchase Specification, Delivery conditions QP & reference codes and standards shall be made available at the place of inspection.
- d) **Inspection Calls:** Bidder shall give inspection call to the respective Employer QA&I RIO in Windsor-X system. For foreign inspection calls Main Contractor shall give inspection call to Employer QA&I (in Windsor-X system) Coordinators and through email as well, as per following schedule:-
- i. Supplier of Indian origin : 15 working days
 - ii. Supplier of Foreign origin : Call will be raised in two stages
 - iii. Preliminary Inspection call : 45 days
 - iv. Final Inspection call : 15 days

Inspection call format is placed at website <http://qains.ntpc.co.in/inspection/>

- e) **Inspection Call Entry on Employer QA&I Inspection Website on Internet:** Bidder can enter the call to the respective RIO on internet on Employer QA&I inspection website named as <http://qains.ntpc.co.in/inspection/> through a user ID & password under the menu "Main Supplier". User ID and password has already been known to various Main Contractor units. Bidder will be allotted user ID and password.

f) **Co-ordination for Inspection Call:**

- Main Contractor shall raise inspection call mentioning all reference documents to the respective Employer QA&I and in Windsor-X system. For foreign inspection calls bidder shall give inspection call to QA&I (in Windsor-X system) Coordinators
- The list of various Employer QA&I RIOs and their address along with their area of jurisdiction is placed at <http://qains.ntpc.co.in/inspection/> The call shall include copy of relevant approved QP and Data Sheet, internal test / inspection report, as applicable etc.
- Bidder representative / their authorized TPA (duly accepted to Employer QA&I) shall involve in inspection activity as per agreed documents.

14. Issue of Final CHP/MDCC/Inspection Report by Employer QA&I: The concerned Regional Inspection Office under whose jurisdiction the manufacturer is located, shall issue the Final CHP/MDCC after successful completion of testing / shop assembly including stage Inspection /Type tests, as required by the approved documents (approved Quality Plan, drawing / data sheet, as applicable), etc. at manufacturer's/ their sub-vendor's works.

METHODOLOGY FOR SAMPLING FOR TESTING OF REPAIRED WELD JOINTS :

Whenever the quantum of check in any NDT is other than 100%, the following guidelines for sampling/resampling procedure for NDT to be followed :

1) The group of welds for sampling shall be based on welding done by a welder in specified continuous time (say work done in a shift or in a day). For further analysis, acceptance or rejection, this group shall be treated as an entity.

2) From the above weld group, the selection of weld joint/weld spot shall be done by NTPC as per the quantum of check specified.

3) For acceptance of the weld group, all samples selected in this group should meet the acceptance norms. In case of any sample(s) beyond acceptance norms, the following actions shall be taken:

3.1: Rectification of defective welds and re-testing of the repair.

3.2 Re-sampling by NTPC from the same group of welds, with quantum of NDT being double the originally specified quantum (with minimum 2 welds for every defective weld). In case of RT on T-joints, if the defect is found on L-seam done at manufacturing works of pipe produced as per IS 3589, pipe defects shall be rectified, and no re-sampling is envisaged.

4) In case of any weld from the re-sample as per 3.2 above found beyond acceptable norms, the following action shall be taken:

4.1) NDT of all welds of the group which were not tested in first and second samples.

4.2) Repair and re-testing of all defective welds.

4.3) Necessary action on process control and on welder for preventing recurrence.

5) For the purpose of sampling, the weld group shall be defined as number of welds in case of smaller diameter of tubes/pipes (or small welds on structures) while for very large diameter pipes e.g., CW piping or for vessels/long welds, the length of weld may be taken as basic unit. Sampling shall also be accordingly in terms of number of weld joints or length of weld.

6) From the time of readiness of weld group, suitable time limits shall be prescribed for first sampling testing, re-sampling, repairing, re-testing etc. (normally not more than 1 day's backlog should be piled up at every step).

Illustration: Radiography of welds: Welding completed on Day-1 should be tested by Day-2 and repair and re-sampling, of the group should be done by Day-3 and further testing/repair should be done by Day-4.

7) Sampling and re-sampling procedure shall be applicable for all NDT viz RT,UT,DPT,MP.

Note: In case of RT of tube welds with double wall image (elliptical view), number of exposures shall be as per relevant code/ plant standard and will not be less than 2 exposures for each weld.

	NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES	FOR NTPC USE ONLY
		NC NO. (REFER NOTE 7):
		DATE:
		PAGE : 1 OF 2
(This page to be filled in by Main Contractor)		
CONTRACT NO : PACKAGE UNIT NO : MAIN CONTRACTOR : SUB-CONTRACTOR : PLACE OF MANUFACTURE:		CATEGORY OF NON-CONFORMITY (AS PER NOTE-2) A ☐ B ☐
DETAILS		
ITEM DESCRIPTION: IDENTIFICATION NO.		
RANGE/SIZE/TYPE: QUALITY PLAN: CHP NO: & CLAUSE NO. ☐		
STAGE OF NON-CONFORMITY: DESIGN (I) / RAW MATERIAL (II) / ASSEMBLY (III) / IN PROCESS (IV) - (SPECIFY) STORAGE (V) / HANDLING (VI) / TESTING (VII) / ANY OTHER (VIII) - (SPECIFY)		
NON-CONFORMITY-DESCRIPTION WITH CAUSE (Attach Relevant Drgs/Details)		
PROPOSED DISPOSITION WITH JUSTIFICATION - (FOR CORRECTION) (Attach details including design calculation, recommendations of qualified designer, if required)		DISPOSITIONING CODE ☐ (AS PER NOTE-6)
STEPS TO PREVENT RECURRENCE-(FOR CORRECTIVE ACTION)		
NAME & DESIGN ENCL:	SIG. OF MAIN CONTRACTOR	DATE _____ (SEAL)



NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES

FOR NTPC USE ONLY

NC NO.(REFER NOTE 7):

DATE:

PAGE : 2 OF 2

NOTES

1. Please read these notes carefully before filling up and attach separate sheet wherever required.
2. Category 'A' non-conformity is a major non-conformity which directly or indirectly adversely affects the performance, reliability, safety, interchangeability, erection, commissioning or working life of the items, equipment or system. All other non-conformities shall be treated as category 'B'.
3. Acceptance of dispositioned non-conformity is without prejudice to NTPC rights under the contract to claim commercial compensation and does not absolve main contractor from his contractual obligations.
4. Obtaining approval of statutory authority, if any, w.r.t. above non-conformity is the responsibility of main contractor.
5. Dispositioning of this non-conformity is for this specific case only and not to be regarded as a precedence.
6. The non-conformance shall be proposed main contractor (Give code at appropriate boxes) and is subjected to review & acceptance by NTPC.
(01) NC-Rejected (02) NC-Conditionally accepted (specify condition) (03) NC-accepted as it is (04) NC-Accepted with repair
7. NC number - this NC no. shall be allotted by regional inspection office in such a way to have project, package, RIO code, followed by running serial no. of that contract.

Responsibilities of main contractor

1. Ascertain exact nature of non-conformity in consultation with qualified designer (if required) and supporting drawing/details with which non-conformity exists.
2. Identify the cause of non-conformity.
3. Decide on code of Dispositioning as per Note-6 above.
4. Ensure and certify that the product quality, performance, reliability and working life is not affected for minor non-conformities and quantify the extent to which it is affected in the case of category 'A' non-conformities.
5. Implement agreed corrective action in a time-bound program.

Responsibilities of RIO

1. Identify the product appropriately.
2. Finalize the cause of non-conformity and propose corrective action.
3. Interlink with the corresponding CHP.

CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
1.01.05.04				
1.01.05.05				
1.01.06				
1.01.07				
1.01.07.01	AUXILIARY POWER CONSUMPTION The respective auxiliary power consumption for unit and the station are to be calculated in isolation to calculate the respective guaranteed power consumption as is illustrated hereunder: Unit Auxiliary Power Consumption The unit auxiliary power consumption shall be calculated using the following relationship with design coal. Pau = Pu + TL (Unit) Pau = Guaranteed Unit Auxiliary Power Consumption. Pu = Power consumed by the auxiliaries of the unit under test. TL = Losses of the Generator Transformer and Unit Transformers supplied by bidder based on works test reports and the criteria specified under the Clause 1.01.07.02 (h) under the subheading Transformers. The power consumption (Pu) of entire unit auxiliaries fed from unit transformers shall be measured at the incomers of respective unit boards. Suitable correction for auxiliaries not in service at the time of this measured power consumption like MDBFP etc, shall be done on as per the technical specification. If GCB scheme is adopted, suitable corrections for station auxiliaries shall be done. While guaranteeing the auxiliary power consumption the bidder shall necessarily include all continuously operating unit auxiliaries. The auxiliaries to be considered shall include but not be limited to the following: (a) Turbine Unit Oil purifier. (b) Turbine Unit control oil purifier. (c) Electric oil heater for turbine lube oil tank (rated power shall be considered). (d) Feed and discharge pumps of turbine oil purification system. (e) Main turbine Condenser air-evacuation pumps. (f) CW pumps (g) Cooling towers (h) Condensate extraction pumps. (i) Drip pump (if envisaged). (j) Hydrazine dosing pumps (if required). (k) Ammonia dosing pumps (if required). (l) Oil purifiers of 2x50% TDBFPs and their feed and discharge pumps.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 18 OF 73

CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES	एनटीपीसी NTPC		
1.01.07.02	ae) Pressurising pumps of fuel oil system af) Power consumption of fans of Air washer units for TG building and fans of air filtration units for ESP and FGD buildings at its rated duty point to be arrived based on shop test. ag) Power consumption of any other continuously operating auxiliary for unit operation at 100% TMCR with Design Coal. ah) GCB Losses of Unit : Losses and fan power for Generator Circuit Breaker (if applicable) Note : - The bidder shall furnish a list of equipment to be covered under Unit auxiliary power consumption, which shall be subject to Employer's approval. - The bidder shall ensure that power supply to all such equipment to be covered under unit auxiliary power consumption is fed from unit board of the respective unit. - Method of Computation of Auxiliary Power consumption for ESP:- The measurement for guaranteed auxiliary power consumption shall be carried out during ESP collection efficiency test. The method for computing the power shall be as described below:- - Power consumption of ESP will be measured pass wise and for one pass (Say ESP-A) at a time with the help of energy meter in ESP MCC. - Energy meter reading will be taken before starting the collection efficiency test and after completion of collection efficiency test. - Before starting collection efficiency test, switch off all the TR sets, all hopper heaters, all insulator heaters/pent house fans (if applicable) and rapping systems serving to one pass (ESP-A) temporally and note down energy meter readings for period t1 i.e. E1. The power consumption shall be $W2=E2/t1$. - During the collection efficiency test the total energy fed in to ESP MCC of one pass (say ESP-A) will be measured during entire period of collection efficiency test i.e. E2. Total time period (t2) of test shall be noted. The power consumption shall be $W2=E2/t2$. During the test all hopper heaters of all ESP passes will be in ON condition and set point temperature shall be kept 5 degree Celsius above the flue gas temperature. - Measured power consumption for one ESP pass (say ESP-A) = $(W2-W1)$ - Measured Electrostatic Precipitator power of one unit = Power of (ESP-A + ESP-B + ESP-C + ESP-D + ESP-E + ESP-F) - Guaranteed Unit Auxiliary Power Consumption of FGD system shall be taken by considering the additional pressure drop in the FGD system during FGD SO2 removal efficiency test at specified guarantee point conditions. For this purpose, difference of FGD system pressure drop during FGD SO2 removal efficiency test and that at Unit Auxiliary Power Consumption test shall be loaded as additional Auxiliary Power Consumption. - Generation from roof top solar during the test period shall be added to the total measured power consumption. Station Auxiliary Power Consumption The station auxiliary power consumption shall be calculated using the following relationship with design coal. P. Stn = Pau. Stn + T_L - Stn			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 20 OF 73	

CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES	एनटीपीसी NTPC																		
	Pau. Stn =SUM (P_i X D_i) Where, P. Stn = Power consumed by the station auxiliaries Pau. Stn = Total Power Consumption, while running at 100% design load for all the auxiliaries of the station supplied by bidder. P_i = Power consumed by each station auxiliary. D_i = Duty factor to be considered for each station auxiliary. T_L - Stn = Transformer Losses of the station transformers and that of any other transformer associated with station auxiliary power supply system (excluding those included in Unit system like GT, UT, UAT,UST etc.) and shunt reactor supplied by the bidder for meeting the station auxiliary power supply shall be included based on work test report. Losses of transformers shall be considered based on the works test reports as per the criteria specified under Clause 1.01.07.02 (h) under the subheading Transformers. While guaranteeing the station auxiliary power consumption the bidder shall necessarily include all the station auxiliaries <u>running at full load</u> with duty factors as have been defined at the ensuing para of this chapter. The station auxiliaries that shall be running during the guarantee test for calculating " Pau. Stn " shall include but not be limited to the following: (Where duty factor is not indicated the same is to be considered as 1.0) a) Plant & Instrument air compressors & Air drying plant Power consumption of:- <table><tr><td>i)</td><td>Instrument Air compressor</td><td>2 Nos.</td><td>Duty Factor =0.6</td></tr><tr><td>ii)</td><td>Plant Air compressor</td><td>1 Nos.</td><td>Duty Factor = 0.33</td></tr><tr><td>iii)</td><td>Air Drying plant (Heaters) (if applicable)</td><td>2 Nos.</td><td>Duty Factor =0.5</td></tr><tr><td>iv)</td><td>Air Drying plant (Blowers) (if applicable)</td><td>2 Nos.</td><td>Duty Factor = 1.0</td></tr></table> Power consumption at rated duty point for compressors to be arrived based on shop test and power consumption at rated duty point for Air Drying plant to be arrived based on site test. b) Air Conditioning & Ventilation System Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of Chilling machines, Chilled water Pumps, Condenser water Pumps, Air handling unit (AHU) fans, for the Air conditioning system of main plant building, FGD control room, ESP control room of each units, . Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of water system control building, and office area in control tower. Power consumption at rated duty point for water cooled chillers & air cooled condensing units shall be based on site test and for other drives like chilled water pumps, Condenser water Pumps & AHU/centrifugal fans shall be based on shop test. (Duty factor for power consumption of A/C equipments of office area in control tower shall be 0.5)	i)	Instrument Air compressor	2 Nos.	Duty Factor =0.6	ii)	Plant Air compressor	1 Nos.	Duty Factor = 0.33	iii)	Air Drying plant (Heaters) (if applicable)	2 Nos.	Duty Factor =0.5	iv)	Air Drying plant (Blowers) (if applicable)	2 Nos.	Duty Factor = 1.0			
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CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
1.02.00	<u>GUARANTEES UNDER CATEGORY - II</u> Noise All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in General Technical Requirement, Part-C Section-VI of the technical specifications. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 61672-1 & 2 (latest edition) Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation. A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.			
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CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES	एनटीपीसी NTPC						
	<u>GUARANTEES UNDER CATEGORY – III</u> 1.03.00 The parameters/capabilities to be demonstrated for various systems/ equipments shall include but not be limited to the following: 1.03.01 Not used 1.03.02 Steam Generator and Auxiliaries Category-III Guarantees of this sub-section for various systems/ equipment for steam generator and auxiliaries shall be based on and demonstrated corresponding to ambient air condition of 27 deg. C temperature & 60% RH. (i) Coal Pulverizer capacity at rated fineness Performance testing shall be conducted on coal pulverizers toward establishing their guaranteed capacity meeting the specification requirement. Corrections may be applied for the variation in coal characteristics i.e. HGI & Total Moisture of test coal with respect to specified design coal. Capacity demonstration test shall be carried out for the following conditions: (a) The Contractor shall demonstrate capacity output on one coal pulverizer (of Employer's choice) of each Steam Generator for establishing its capacity at 100% mill loading, at rated pulverized coal fineness with specified design coal with new set of grinding elements. (b) Further, Contractor shall also demonstrate capacity output on four coal pulverizers (of Employer's choice) of each Steam Generator, not less than the 90% of guaranteed value of (a) above, at 100% mill loading with the originally installed grinding elements in nearly worn-out condition or at the end of guaranteed wear life of grinding elements, whichever is earlier. Capacity test as mentioned at a & b above shall be demonstrated at the following conditions occurring simultaneously during testing: <table><tr><td rowspan="2">Rated pulverised coal fineness</td><td>i. not less than 75% through 200 mesh and</td></tr><tr><td>ii. not less than 99% through 50 mesh screen</td></tr><tr><td>Test Coal</td><td>Any available coal from the specified range</td></tr></table> In case the Contractor successfully demonstrates the guaranteed capacity of coal pulverizers as stated above, remaining coal pulverizers of corresponding steam generator will also be considered to have successfully met the above capacity guarantee requirement. However, in the event of any of the coal pulverizers not meeting the guarantee test, all the coal pulverizers of corresponding steam generator will have to be tested by the contractor to demonstrate guaranteed capacity. During the demonstration of the mill capacity output, manufacturer's operating instructions will be followed and mill will be operated with the specified range of coals without any such readjustment that requires a shutdown of the mill or reduction of the load and/or any replacement of any mill wear parts. For the purpose of testing to demonstrate the capacity, if HGI (grindability) and total moisture vary from those given in coal characteristics, the above pulverizer measured capacity shall be corrected using the capacity correction curves furnished	Rated pulverised coal fineness	i. not less than 75% through 200 mesh and	ii. not less than 99% through 50 mesh screen	Test Coal	Any available coal from the specified range		
Rated pulverised coal fineness	i. not less than 75% through 200 mesh and							
	ii. not less than 99% through 50 mesh screen							
Test Coal	Any available coal from the specified range							
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 27 OF 73					

CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES	एनटीपीसी NTPC		
1.03.04	Air Conditioning & Ventilation System (i) Air Conditioning System: A. Following shall be demonstrated at Shop - Capacity and discharge pressure of chilled water pumps, condenser water pumps at its rated duty point. - Capacity and static pressure of AHU fans at its rated duty point. B. Following shall be demonstrated at Site - Capacity (TR) of water cooled chillers for A/C system of Main Plant Area (TG Building), and A/C system of ESP control rooms. - Capacity (TR) of Air cooled condensing (D-X) unit for A/C system of ESP control building - Guaranteed room conditions during summer for all the Air conditioned areas. - Parallel operation of chilled water and condenser water pumps. - Vibration level of chillers, condensing units, centrifugal fans of AHUs and all pumps. (ii) Ventilation System A. Following shall be demonstrated at Shop - Capacity and discharge pressure of pumps of air washer units and UAF units at its rated duty point of Ventilation system. - Capacity and static pressure of centrifugal fans, roof exhausters at its rated duty point of Ventilation system. B. Following shall be demonstrated at Site - Parallel operation, Vibration level of centrifugal fans & pumps of Ventilation system.			
1.03.05	Not Used			
1.03.06	The parameters/capabilities to be demonstrated for following systems/ equipments of Raw Water Pump House and ACW pump house (as applicable) shall be:			
1.03.06.01	(i) EOT/GANTRY Cranes: Over load tests, travel and hoist speed checks as per relevant Indian standards IS (latest edition).			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 31 OF 73	

CLAUSE NO.	GUARANTEE TEST PROCEDURE 										
	ANNEXURE – IIA FORMAT FOR SUBMISSION OF GUARANTEE TEST PROCEDURE <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="427 380 695 583"> Clause No. as per LOA/ Tech. Specs. </th> <th data-bbox="695 380 932 583"> Provision of LOA / Tech. Specs. </th> <th data-bbox="932 380 1179 583"> Name and Methodology of Test proposed by Vendor </th> <th data-bbox="1179 380 1416 583"> NTPC comments on the tests proposed by vendor </th> </tr> </thead> <tbody> <tr> <td style="height: 500px;"></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Clause No. as per LOA/ Tech. Specs.	Provision of LOA / Tech. Specs.	Name and Methodology of Test proposed by Vendor	NTPC comments on the tests proposed by vendor				
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SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 65 OF 73								

CLAUSE NO.	GUARANTEE TEST PROCEDURE 																												
	APPENDIX-IV 7. Energy meter Readings <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="505 378 594 548" rowspan="2">Sl.</th> <th data-bbox="594 378 730 548" rowspan="2">Equip- Ment</th> <th colspan="2" data-bbox="730 378 932 548">Time Duration</th> <th colspan="2" data-bbox="932 378 1146 548">Energy meter Readings kWhr</th> <th data-bbox="1146 378 1317 548">Equipment kw (R2-R1)/ (t2-t1)</th> <th data-bbox="1317 378 1461 548">Remarks*</th> </tr> <tr> <th data-bbox="730 548 831 789">Initial</th> <th data-bbox="831 548 932 789">Final</th> <th data-bbox="932 548 1032 789">Initial</th> <th data-bbox="1032 548 1146 789">Final</th> <th data-bbox="1146 548 1317 789"></th> <th data-bbox="1317 548 1461 789"></th> </tr> </thead> <tbody> <tr> <td data-bbox="505 789 594 1310" style="height: 200px;"></td> <td data-bbox="594 789 730 1310"></td> <td data-bbox="730 789 831 1310"></td> <td data-bbox="831 789 932 1310"></td> <td data-bbox="932 789 1032 1310"></td> <td data-bbox="1032 789 1146 1310"></td> <td data-bbox="1146 789 1317 1310"></td> <td data-bbox="1317 789 1461 1310"></td> </tr> </tbody> </table> *Reason and duration for system trip/stop may be recorded in remarks column. NTPC Contractor							Sl.	Equip- Ment	Time Duration		Energy meter Readings kWhr		Equipment kw (R2-R1)/ (t2-t1)	Remarks*	Initial	Final	Initial	Final										
Sl.	Equip- Ment	Time Duration		Energy meter Readings kWhr		Equipment kw (R2-R1)/ (t2-t1)	Remarks*																						
		Initial	Final	Initial	Final																								
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.		SUB-SECTION-IV FUNCTIONAL GUARANTEES		PAGE 69 OF 73																							

CLAUSE NO.	GUARANTEE TEST PROCEDURE 																			
	APPENDIX-V GUARANTEE TEST PROFORMA VIBRATION LEVEL MEASUREMENTS Project : Package : Date : Time : Details of vibration Level Meter 1. Make 2. Model & Sl.No. 3. Date of calibration with name of Test House <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <th rowspan="2" style="width: 10%;">Sl.No.</th> <th rowspan="2" style="width: 20%;">Equipment</th> <th rowspan="2" style="width: 10%;">Pick *Point</th> <th colspan="3" style="width: 60%;">Vibration level Amplitude/Velocity</th> </tr> <tr> <th style="width: 20%;">Horizontal Micron/ mm/ sec.</th> <th style="width: 20%;">Vertical micron/ mm/sec.</th> <th style="width: 20%;">Axial Micron / mm/sec.</th> </tr> <tr> <td style="height: 40px;"></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> * Reading shall be taken at all the bearings of motor, gear box and driven equipment. In case of conveyor galleries, vibrations shall be measured at min. three locations, at midpoint of stringer between two short supports. NTPC Contractor					Sl.No.	Equipment	Pick *Point	Vibration level Amplitude/Velocity			Horizontal Micron/ mm/ sec.	Vertical micron/ mm/sec.	Axial Micron / mm/sec.						
Sl.No.	Equipment	Pick *Point	Vibration level Amplitude/Velocity																	
			Horizontal Micron/ mm/ sec.	Vertical micron/ mm/sec.	Axial Micron / mm/sec.															
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.		SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 70 OF 73															

CLAUSE NO.	GUARANTEE TEST PROCEDURE																
	APPENDIX-VI GUARANTEE TEST PROFORMA NOISE LEVEL MEASUREMENT Project : Package : Date : Details of Sound Level Meter - Make - Model - Date of calibration with name of Test House <table border="1" data-bbox="436 896 1468 1453"> <thead> <tr> <th>Sl.No</th> <th>Equipment with location</th> <th>Equipment load/capacity</th> <th>Measurement* point no.</th> <th>Sound level dBA.</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> NTPC Contractor * For each equipment location, a Projected Plan Diagram shall be made and the location of measurement points shall be identified.					Sl.No	Equipment with location	Equipment load/capacity	Measurement* point no.	Sound level dBA.	Remarks						
Sl.No	Equipment with location	Equipment load/capacity	Measurement* point no.	Sound level dBA.	Remarks												
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 71 OF 73														

Sub : Sub-Qualifying Requirements for the Air Conditioning System

- (A) In line with the Sub-Qualifying Requirements stipulated in Clause No. 4.5 of Sub-Section-IA, Part-A of Section-VI, we/our sub-vendor hereby confirm that we/our sub-vendor have designed, supplied, erected and commissioned atleast One (1) number of Air Conditioning systems having a total installed capacity of 300TR or more including stand-by chiller unit (if any), which included atleast one chilling unit with a minimum capacity of 60 TR. The system have been in successful operation for atleast One (1) year. The details are given below:

Sl.No.	Item Description	Plant No. 1
1.	Name of the Client with full address, contact person(s), fax and tele no.	
2.	Name and address of the Plant	
3.	Purchase Order no. and date	
4.	Copy of purchase order enclosed	Yes/No
5.	Date of Commissioning	
6.	No. of years of successful operation	
7.	Whether clients certificate is enclosed to prove that "the Air Conditioning system is in successful operation for atleast one (01) year.	Yes/No
8.	Total installed capacity of air conditioning system (should be atleast 300 TR)	 TR
9.	Capacity of largest chilling unit in above air conditioning system (should be atleast 60 TR)	 TR
10.	Type of installation	Industrial/ Commercial Installation
11.	The scope of Contract included	
	(a) Design	Yes/No
	(b) Supply	Yes/No

Signature of authorized signatory.....

Sl.No.	Item Description	Plant No.1
	(c) Erection	Yes/No
	(d) Commissioning	Yes/No
12.	Documentary evidence in support of above enclosed	Yes/No

- (B) We further declare that the chillers to be supplied under the package shall be sourced from manufacturer M/s..... who has manufactured and supplied atleast One (1) no. of similar type of chiller unit having a capacity of not less than 150 TR and have been in successful operation for atleast One (1) year.

Chillers proposed to be supplied under this package would be sourced from following manufacturers. Experience details of the manufacturers are given below:

- | | | |
|-----|--|------------------|
| (a) | Type of vapor compression type chilling unit offered | Screw compressor |
| (b) | Name and Address of Manufacturer from whom the above equipment is sourced | |
| (c) | For the above type of chiller Experience details of the Manufacturer is as follows : | |

Sl.No.	Item Description	Plant No.1
1.	Name of the Client with address, name of contact person(s), tel. no. & fax no.	
2.	Purchase Order no. and date	
3.	Date of Commissioning	
4.	No. of years of successful operation	
5.	Capacity of chiller unit	 TR

Signature of authorized signatory.....

Sl.No.	Item Description	Plant No.1
6.	Clients certificate to demonstrate successful operation of machine for at least one (01) year.	Yes/No
7.	Documentary evidence in support of above enclosed	Yes/No

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common Seal).....

Signature of authorized signatory.....

Sub : Sub-Qualifying Requirements for the Ventilation System

In line with the Sub-Qualifying Requirements stipulated in clause no. 4.6 of Sub-Section-IA, Part-A, Section-VI of Technical Specification of Bidding Documents, we/our Sub-vendor have designed, supplied, erected and commissioned atleast One (1) number ventilation system including similar air washer units having individual fan capacity of 80,000 Cum/hr. or more the system are in successful operation for atleast One (1) year.

Sl.No.	Item	Plant 1
1.	Name of the Project and its address	.....
2.	Name of the Client with address, name of Contact person(s) with tel.no. & fax no.	.....
3.	Order No. and date	
4.	Purchase order enclosed	Yes*/No*
5.	Date of commisioning	.....
6.	Individual fan capacity of air washer unit in ventilation system, cu.m/hr.	.....
7.	The scope for the ventilation system contract included	
	(a) Design	Yes*/No*
	(b) Supply	Yes*/No*
	(c) Erection	Yes*/No*
	(d) Commissioning	Yes*/No*
8.	No. of years of successful.	.....
9.	The installation where the ventilation system has been provided can be treated as Industrial/commercial installation	Yes*/No*

Signature of authorized signatory.....

Sl.No.	Item Description	Plant No.1
10.	Documentary evidence in support of above is enclosed	Yes*/No*
11.	Clients certificate regarding successful operation of ventilation system enclosed	Yes*/No*

* Strike off whichever is not applicable.

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common seal).....

Note : Continuation sheets of like size and format may be used as per Sub-vendor's requirement and shall be annexed to this Attachment-3K.

Signature of authorized signatory.....

STANDARD PERFORMANCE GUARANTEE AND ACCEPTANCE TEST

PROCEDURE FOR AIRCONDITIONING SYSTEM FOR VARIOUS AREAS OF

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	1.0.0 INTRODUCTION In accordance with the condition of contract /letter of award on successful completion of system trial operation at site and liquidation of all defects, the system/ individual equipments shall be subjected to performance and Guarantee Tests at site. 2.0.0 SCOPE The test procedure shall cover the Performance and Guarantee Tests to be conducted at site for the entire system / subsystems and individual equipments covered in the A.C. Package. The test procedure shall cover the testing method for parameters covered as — Guaranteed Parameters in LOA and checking of ratings and performance requirements stipulated for various equipments covered in the specifications. 3.0.0 OBJECTIVE OF THE TEST 3.1.0 To check healthy working of all the equipments forming the total air conditioning system. 3.2.0 To check the power consumption of the motors for which power consumption limits are guaranteed at specified capacity of equipments. 3.3.0 To verify the total capacity of the plant including stand-by equipments. The tonnage rating obtained from all AHUS/Chillers is to be cross checked from the heat rejection across the condensers. However, capacity of plant shall be verified during summer (May-August) but room temperature verification for 24 hours shall be done in both summer and monsoon. 3.4.0 Capacity rating and guaranteed power consumption to be established during summer only during May to August when the ambient temperature (DBT) is generally high (Additional heating load if required shall be provided by NTPC / Vendor). 3.5.0 To check the temperature and relative humidity conditions during summer and monsoon in the air-conditioned space with those incorporated in the contract. However Relative Humidity shall not be guaranteed for areas catered by High wall/Cassette/Ductable split air conditioners 3.6.0 Operating parameters of the system to be logged for complete cycle with calibrated instruments at the time of capacity test during summer. 3.7.0 Operating parameters of the system to be logged with online instruments except calibrated psychrometer for Room condition test during Monsoon test. 3.8.0 To check satisfactory operation of all safety switches and electrical interlocks for each individual equipment and for the complete system. 3.9.0 Vibration and noise level to be measured for all rotating equipments.		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 180 of 227

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	4.0.0 CONDITIONS OF TEST 4.1.0 Conductance of test Performance and Guarantee Test at site shall be conducted by accredited representatives of the CONTRACTOR/ Vendor and NTPC Limited. The contractor shall be given permission to inspect the entire system in advance and make it ready for test. Contractor representatives shall witness and associate with all phases of test and record the data jointly with NTPC representatives. 4.1.1 The responsibility for conducting the test rests with the contractor. 4.2.0 TEST INSTRUMENTS 4.2.1 All instruments required for the PG test will be provided by the contractor at their cost. 4.2.2 Calibration of test instruments shall be responsibility of the contractor. 4.2.3 Calibration of instruments (to be used in the test) shall be carried out at a Govt. /NTPC approved test laboratory. 4.2.4 Calibration of the instruments should be carried out prior to, but not more than six months before the commencement of the test. The calibration certificate of the instruments should be valid for the period of the test. 4.2.5 Calibration certificates (in original) of all instruments from Govt. /NTPC approved Test Laboratory shall be submitted by the contractor for NTPC approval prior to start of the test. Original Calibration certificate will be returned to Contractor after review & acceptance of the certificate. 4.2.6 All the calibrated instruments preferably shall be sealed after calibration at Test Lab & intactness of the seal shall be checked by NTPC before start of the test. If sealed, NTPC shall issue a certificate confirming the breakage of the seal after verification of instruments. 4.2.7 All on line instruments, which will be used during the test, shall be calibrated at Govt. /NTPC Test Laboratory. 4.2.8 On line pressure gauges shall be used for recording the parameters of compressor cycle. 4.2.9 Calibrated gauges of $\pm 0.5\%$ accuracy shall be used on water circuit for pressure and temperature measurement. 4.2.10 Airflow of AHU shall be measured by using calibrated anemometer / velometer.		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 181 of 227

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	4.2.11 Bearing temperature is to be measured with thermometer of ± 1 degree C accuracy with Least count LC of 0.5 degree C. 4.2.12 Dry and wet bulb temperatures shall be measured using sling psychrometers. The thermometers of sling psychrometer shall be of $\pm 0.5\%$ accuracy with LC of 0.5 degree C. 4.2.13 All power consumption measurements shall be done by 2-wattmeter method OR Clamp-ON power analyser/tong tester method of accuracy class $\pm 1\%$ duly calibrated shall be used. 4.2.14 Tachometer for RPM measurement shall be of $\pm 1.0\%$ accuracy. 4.2.15 Calibrated instruments shall be used for vibration and noise level measurement. 4.3.0 PRE-REQUISITES TO THE PG TESTS. 4.3.1 The contractor should furnish a written statement to the effect that work covered in the contract has been completed for the system for which PG test will be carried out. 4.3.2 All the erection /commissioning protocols in respect of hydro test of pipe lines headers, alarm /annunciation /control system, vibration and noise level data of AHU, condenser and chiller pump etc. During commissioning shall be made available during PG test by the Contractor. 4.3.3 All NTPC approved data sheets for the plant /system for which PG test is to be carried out to be made available during PG test. 4.3.4 Uninterrupted power supply within specified parameters for the duration of the Test to be ensured by other agencies 4.3.5 Proper lubrication and oil level of all equipments to be ensured. 4.3.6 Cleanliness of plant /system 4.3.7 Protection relays of switchgears and all motor feeders shall be checked by other agencies. 4.3.8 Readiness of all protections, interlocks and safety switches to be ensured. Joint protocol in this respect shall be signed 4.3.9 Availability of suitable fire protection systems /fire fighting equipments to be ensured by other agencies during PG test. 4.3.10 Deputation of team to site to associate with the P&G test to be ensured by the contractor.			
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 182 of 227	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	4.3.11 Arrangement of all calibrated test instruments as per cl 4.2.0 to be ensured by the contractor. 4.3.12 The plant /system shall be jointly inspected by NTPC and the contractor and a joint protocol shall be signed that the plant is fit for P&G Test. 4.3.13 All the power measurement shall be done by 2 watt meter method. The watt meters of accuracy +/- 1% duly calibrated shall be used. 4.4.0 GUARANTEED PARAMETERS DECLARATION 4.4.1 The contractor should furnish a declaration in the manner as per Appendix -I for the guaranteed parameters which attract levy of liquidated damages for Shortfall in performance. Also declaration shall be given by contractor for other parameter covered as guaranteed parameter (Without liquidity damages). 4.4.2 TEST METHODOLOGY The test can be classified into four following groups: 1) Equipment performance 2) Capacity Assessment - Verify the plant capacity (tonnage rating) during summer (May to August) when ambient temperature (DBT) is generally high. 3) Power consumption -At specified capacity of the equipment 4) Room condition test- During summer and monsoon. 5.0.0 Equipment performance The plant should run continuously for 2 to 3 hours for stabilization of the system before measurements. After stabilization of the system, various parameters of the major equipment will be recorded in hourly log sheet. Four sets of such readings are to be recorded under stable conditions. Following are the parameters to be recorded during equipment performance check 5.1.1 Current rating and voltage of all motors with on line panel meter or calibrated tong tester to be logged. 5.1.2 Bearing temperature of all motors with calibrated thermometer. 5.1.3 Pressure of water at condenser water pump inlet and outlet with calibrated gauges (To be done preferably with differential pressure gauge in order to avoid inaccuracy).		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 183 of 227

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	5.1.4 Pressure of water at chilled water pump inlet and outlet with calibrated gauges (To be done preferably with differential pressure gauge in order to avoid inaccuracy). 5.1.5 Temperature of water at condenser inlet and outlet with calibrated gauges. 5.1.6 Temperature of water at chiller inlet and outlet with calibrated gauges. 5.1.7 Dry and wet bulb temperature of entering air to AHU and of leaving air from cooling coil with calibrated psychrometer. DBT and WBT measurement of leaving air from Cooling coil of AHU shall be done at plenum or canvas connection of AHU. 5.1.8 Velocity of air shall be measured on the filters at the suction area the AHUs with calibrated anemometer /velometer. 5.1.9 After completion of capacity tests, working of heaters and humidifiers shall be demonstrated by adjusting the set points. The instruments controlling these equipments are to be kept in their set points during PG test and shall operate automatically only, if the inside conditions demand for. 5.1.10 Following shall be checked for cooling tower - Correct direction of fan with proper orientation of leading and trailing edges shall be checked. - Free & clear flow of all nozzles shall be checked. - Inlet & outlet temperature of cooling tower shall be recorded. 5.1.11 Speed of rotating equipment, wherever possible, shall be checked with calibrated Tachometer. 5.1.12 Proper working of modulating type mixing valves to be demonstrated by adjusting set points. 5.1.13 Noise and vibration level measurement Vibration and noise level of compressor, condenser water pump, chilled water pump, AHU fan, cooling tower motor shall be measured during PG test. Permissible limit of vibration for pumps shall be ___ microns peak to peak and for AHU, shall be in line with VDI-2056 class IV machines (good zone). Vibration level of compressor shall not exceed ___ mm/sec RMS velocity. Vibration level of Cooling Tower and other equipments shall be as per manufacturer recommendation shall be made available during testing. However acceptance vibration limit of all the equipments shall be made available at the time of testing. The maximum noise level shall be ___dbA at 1.5 meter elevation and at a horizontal distance of 1.0 meter from the equipment. 5.1.14 Parallel operation of chilled water pumps and condenser water pumps to be demonstrated at site.		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 184 of 227

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	5.2.0 CAPACITYASSESSMENT: i) CHILLED WATER SYSTEM: The capacity of the plant shall be assessed by chiller method as detailed in 5.2.2. The same will however, be cross checked also by condenser and AHU method as detailed at 5.2.3. and 5.2.1 respectively. In centralised chiller plant cumulative tonnage capacity (by chiller method) of all running equipment shall match with all running AHU's chiller system ii) PAC /AIR-COOL CONDENSING UNIT PAC/Air Cooled condensing units is -Direct Expansion type of AC Plant and hence the capacity of these units shall be assessed based on AHU method as detailed below in 5.2.1 (iii) AIR COOLED CHILLING SYSTEM: The capacity of the plant shall be assessed by chiller method as detailed in 5.2.2. The same will however, be cross checked also by AHU method as detailed at 5.2.1. In centralised chiller plant cumulative tonnage capacity (by chiller method) of all running equipment shall match with all running AHU's chiller system 5.2.1 Plant capacity from AHU method For verifying the plant capacity by AHU method the total air quantity handled by individual AHU shall be measured as mentioned below: Air quantity measurement will be taken on filters in front of AHU suction area. The air velocity shall be measured with calibrated anemometer / velometer. While taking this measurement, the following conditions are to be maintained: - All the AHUs except the standby unit should be in running condition. - Doors leading to AHU room should be kept closed and all other openings in AHU room as well as in the air-conditioned space and the areas in the return air path are to be sealed. - Air quantity of fresh air should be measured and damper is to be adjusted to allow the required quantity of fresh air only. - Air velocity should be measured using calibrated Anemometer /velometer. Velocity shall be taken at 9 traverse in the direction perpendicular to AHU suction area on the each filter. Measurements shall be carried out to compute average air flow.		
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AHU being the ultimate equipment for heat transfer, capacity of the system shall be arrived at by calculations based on various recorded data of AHU.

It is to be ensured that while recording different parameters of AHU, the compressor shall run at full load.

METHOD OF CALCULATIONS:

$$\text{AHU capacity (TR)} = Q_a \times (E1 - E2) \times D / 3024$$

Where, Q_a = Quantity of air in M³/hr
 D = Density of air at AHU inlet in kg/m³
 $E1$ = Enthalpy of entering air at AHU in Kcal/kg
 $E2$ = Enthalpy of leaving air from AHU in Kcal/kg

Q is to be calculated by multiplying mean velocity of air by inlet suction area of AHU.

i.e. Q (in M³/hr) = Effective Filter size x No of Filters x Average Velocity x 3600

$E1$ & $E2$ are to be found out by plotting dry and wet bulb temperatures of entering and leaving air on psychometric chart.

5.2.2 PLANT CAPACITY FROM CHILLER:

Capacity of plant shall be assessed by chiller method. Same however will be cross checked by AHU method as detailed in 5.2.1

$$\text{TR} = \frac{Q_w \times (T1 - T2) \times 1000}{3024}$$

Where

TR = Capacity in TR

Q_w = Water flow rate through chiller (M³/Hr) = Quantity of water circulated by chilled water pump in M³/Hr

$T1$ = Water temperature at chiller inlet (°C)

$T2$ = Water temperature at chiller outlet (°C)

1000 = Multiplying factor

Q_w is to be obtained from the characteristic curve of the chiller water pump and pressure differential across the pump. Necessary correction for actual speed with respect to design speed shall be made. Original Characteristic curves of the chiller water pump shall be submitted by vender along with test results.

5.2.3 PLANT CAPACITY FROM CONDENSER/ HEAT REJECTION FROM CONDENSER

Heat rejection across the condenser should be equal to the sum of the heat absorbed by the evaporator (cooling coil) and the equivalent heat of the compressor shaft K.W.

Heat absorbed by the evaporator maybe calculated from the corresponding data of the AHU recorded simultaneously by the formula in 5.2.1 above

Heat rejection across the condenser (Kcal/hr)

$$=Q_w \times (T_1 - T_2) \times 1000 \text{ k-Cal/Hr} \dots\dots\dots A$$

Where,

Q_w = Water flow rate thru condenser (M^3/Hr) = Qty of water circulated by cond. water pump in M^3/hr

T_1 = Water temp. at condenser outlet (degC)

T_2 = Water temp. at condenser inlet (degC).

1000 = Multiplying factor

Q_w is to be obtained from the original characteristic curve of the pump and pressure differential across the pump. Necessary correction for actual speed with respect to design speed shall be made.

Characteristic curves of the condenser water pump shall be submitted by the vendor along with test result.

Heat equivalent of compressor shaft KW (Kcal/hr) = Input KW of compressor motor x motor efficiency x 860..... B

1KW = 860 Kcal

Tonnage Capacity= (A-B)/3024

Since 1Ton = 3024Kcal/hr.

5.3.0 POWER CONSUMPTION TEST:

Measurement of power for all motors shall be done by Power Analyzer or Two wattmeter method only. Power measurements shall be done at rated capacity during capacity test of equipments.

5.4.0 ROOM CONDITION TEST:

Room condition test shall consist of taking the readings of dry and wet bulb temperatures at different location points to be mutually decided at site in the areas which are air-conditioned by the respective system /plant. Room Condition test shall be done after stabilization of system.

The dry and wet bulb temperature shall be measured by sling psychrometer which will have accuracy of $\pm 0.5\%$ with a least count of 0.5°C .

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	This will be carried out for 24 hours continuously and readings will be taken every two hours. Standby equipment should be changed over during this 24 hours. This test shall be carried out during summer when the maximum ambient temperature is at least 40°C and during monsoon when relative humidity prevalent is not less than (-)10% of design value. 6.0.0 AIR COOLED CONDENSOR SYSTEM 6.1.1 PLANT CAPACITY FROM AHU METHOD For verifying the plant capacity by AHU method total air quantity handled by individual AHU shall be measured as mentioned below. Air quantity measurement will be taken in AHU suction in a direction perpendicular to AHU suction area. The air velocity shall be measured with calibrated anemometer/Velometer. While taking this measurement, following conditions are to be maintained: I. All the AHUs except the standby should be in running condition. II. Doors leading to AHU room should be kept closed and all other openings in AHU room as well in the air conditioned space and areas in return path are to be sealed. III. Air quantity of fresh air should be measured and damper to be adjusted to allow the required quantity of fresh air only. IV. Air velocity shall be measured using calibrated Anemometer / velometer. Velocity shall be taken at 9 traverse points in a direction perpendicular to AHU suction area. Measurements shall be carried out to compute average air flow. AHU being the ultimate equipment for heat transfer, capacity of the system shall be arrived at by calculations based on various recorded data of AHU. It is to be ensured that while recording different parameters of AHU the compressor shall be at full load. METHOD OF CALCULATION $T = Q \times d \times (E1-E2)$ Where T= Capacity in TR Q= Quantity of air in m³/hr d= density of air at AHU inlet in Kg/m³ (At AHU inlet temperature and pressure to be measured and density to be calculated) E1= Enthalpy of entering air at AHU in Kcal/kg E2 = Enthalpy of leaving air from AHU in Kcal/kg Q is to be calculated by multiplying mean velocity of air by inlet suction area of AHU. i.e. Q (in M³/hr)= Effective Filter size x No of Filters x Average Velocity x 3600	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	E1 & E2 are to be found out by plotting dry and wet bulb temperatures of entering and leaving air on psychometric chart. 6.1.2 PLANT CAPACITY FROM CONDENSOR Heat rejection across the condenser should be equal to sum of the heat absorbed by the evaporator (cooling coil) and the equivalent heat of compressor shaft KCal/Hr. Heat absorbed by the evaporator may be calculated from corresponding data of AHU recorded simultaneously by the formula of 6.1.1 above. Heat rejection across the condenser (K Cal/Hr) $Q_a = \dot{m}_a \times C_p \times \Delta T (T_1 - T_2) \dots\dots\dots A$ Where Q_a = Heat rejection capacity of compressor (KW) $\dot{m}_a$ = mass flow rate of air ($V_a \times D_a$) Kg/sec V_a = Volume flow rate per fan M³/sec D_a = Density of Ambient Air 1.0933 Kg/sec C_p = Specific heat of air 1.006 KJ/KgK T_1 = Outlet air temp in ° C at condenser T_2 = Inlet temperature in ° C at condenser Q_a is to be obtained from condenser approved data sheet/selection sheet Original Characteristics curves of the condenser fan shall be submitted by the vendor along with test results Heat equivalent of compressor shaft (Kcal/hr) = Input KW of compressor motor x motor efficiency X 860 B (As 1KWh =860 KCal) Tonnage Capacity= (A-B)/3024 Since 1TR= 3024 KCal / Hr		
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ANNEXURE – I

TECHNICAL PARAMETERS OF AC SYSTEM

Design Ambient Temperature (summer)	i) DB –°C
	ii) WB –°C
Design Ambient Temperature (monsoon)	i) DB –°C
	ii) WB –°C
Design Ambient Temperature (winter)	i) DB –°C
	ii) WB –°C

Design Indoor Conditions

i) All Building	DB 24°C±1°C	RH 50%±5%
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Selected AC plant capacity as per NTPC Technical specification/Heat load calculation.

Sl. No.	Item	Capacity (each)	Quantity
1.0	Centralized AC system for Main plant Control Rooms		
1.1	Water cooled Chiller	 TR	(.....Working +Standby)
1.2	Chilled water pumps & motor	 m ³ /hr at MWC	(.....Working +Standby)
1.3	Condenser cooling water pump & motor.	(.....Working +Standby)	(.....Working +Standby)
1.4	Cooling tower with fan & drive.	 m ³ /hr	(.....Working +Standby)
1.5	Air Handling Units	 m ³ /hr	(.....Working +Standby)
2.0	A/C system for ESP Control Room of Unit #1 & #2		
2.1	Air cooled condensing units.	 TR	(.....Working +Standby)
2.2	Air Handling Units	 m ³ /hr	(.....Working +Standby)
3.0	A/C system for Water System Control Building.		
3.1	Air cooled condensing units.	 TR	(.....Working +Standby)
3.2	Air Handling Units	 m ³ /hr	(.....Working +Standby)

Note : Bidder to indicate equipment rating for ASH handling plant VFD/control room, FGD control room, VFD control of Air cooled condenser(if applicable), Simulator Building (if applicable) and other buildings as per scope of work.

Appendix – I

GUARANTEED PARAMETERS WITH LIQUIDATED DAMAGES

Main Power House (TG Building)

SL NO	EQUIPMENT DESCRIPTION	DUTY	Absorbed power (Guaranteed) at motor input terminal.	Value Tested During PG test
1	Water cooled Chiller - 1	(Continuous/St andby)	....	.....
2	Water cooled Chiller - 2		....	.....
3	Water cooled Chiller - 3		....	.....
4	Chilled water pumps – 1		....	.....
5	Chilled water pumps – 2		....	.....
6	Chilled water pumps – 3		....	.....
7	Condenser water pumps – 1		....	.....
8	Condenser water pumps – 2		....	.....
9	Condenser water pumps – 3		....	.....
10	AHU - 1		....	.....
11	AHU - 2		....	.....
12	AHU - 3		....	.....

FGD control room, ESP control room of each units, ~~AHP control room-~~

SL NO	EQUIPMENT DESCRIPTION	DUTY	Absorbed power (Guaranteed) at motor input terminal.	Value Tested During PG test
1	Water cooled Chiller - 1	(Continuous/St andby)	....	.....
2	Water cooled Chiller - 2		....	.....
3	Water cooled Chiller - 3		....	.....
4	Chilled water pumps – 1		....	.....
5	Chilled water pumps – 2		....	.....
6	Chilled water pumps – 3		....	.....
7	Condenser water pumps – 1		....	.....
8	Condenser water pumps – 2		....	.....
9	Condenser water pumps – 3		....	.....
10	AHU - 1		....	.....
11	AHU - 2		....	.....
12	AHU - 3		....	.....

Water System Control Building

SL NO	EQUIPMENT DESCRIPTION	DUTY	Absorbed power (Guaranteed) at motor input terminal.	Value Tested During PG test
1	Air Cooled	(Continuous/St		

CLAUSE NO.	TECHNICAL REQUIREMENTS				
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2	Condensing Unit - 1	andby)		
3	Air Cooled Condensing Unit - 2			
4	AHU - 1			
5	AHU - 2			

Total cumulative power consumption of AC system package is KW as per bidding documents. (Bidder to attach relevant page of bidding document)

Note: The above list is indicative only. Bidder to furnish the guaranteed power consumption of all equipment which attract Liquidated damages as per specification/contract.

Project :, STAGE-.... (...x..... MW) Package: Air condition System COA No. : Contractor: Owner :NTPC Limited STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE AIR CONDITIONING SYSTEM					
Equipment	Description of Parameter	Guaranteed Value as per LOA	Quantity (Working quantity as per Tech. Spec.)	Value Noted during PG Test	
AC Plant for Main Plant Area: TG BUILDING					
1	Chilling Unit Plant .	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	 KW	Nos	
2	Chilled Water Pump for main AC Plant M³/hr at ....M total Head	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	KW	Nos	
AC Plant for ESP Building & WSCB					
3	CONDENSING UNITS: TR	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	KW	Nos.	
4	CONDENSING UNITS: TR .	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	 KW	 Nos.	
5	Condenser Water Pump for main AC Plant ....M³/hr at ....M total Head	Auxiliary Power consumption in KW at motor input terminal at rated duty point for each drive	KW	Nos.	
AHU Fans for Various Areas					
6	i) AHU - 1 to 6 - M³/hr at ....mmWC	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	KW	Nos	
	ii) AHU - 7 to 8 - M³/hr at ....mmWC	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	KW	Nos	

LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 192 of 227
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CLAUSE NO.	TECHNICAL REQUIREMENTS					
	iii) AHU - 9 to ...No.s - ...M ³ /hr at .mmWC	Auxiliary Power consumption in KW at motor terminal at rated duty point for each drive	...KW	...Nos		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION- VI, PART - B		SUB SECTION- G-04 STANDARD PG TEST PROCEDURE		Page 193 of 227

OTHER GUARANTEED PARAMETERS (Without liquidity damages)

[illegible]

Contractor :

Appendix I

FORMAT FOR RECORDING AIR QUANTITY ACROSS AHU

Project :....., **STAGE-.... (...x.... MW)**

Package: Air condition System COA No. :.....

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Date :

Reading Set : Unit of Operation No. of Filters : Effecting Filter Size (L x W) m² :

[illegible]

Average Velocity (m/s) :

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Appendix - II

Project :, STAGE-.... (...x..... MW)

Package: Air condition System COA No. :

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE
FOR AC SYSTEM

Date :

FORMAT OF CHECKING POWER CONSUMPTION OF MOTORS - AIR CONDITIONING PACKAGE

SL No	Time in hr	Current in amps	Voltage in volts	Wattmeter reading	Actual power	Power factor	Remarks
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			

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Appendix -III

Project :....., STAGE-.... (...x..... MW)

Package: Air condition System COA No. :.....

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Date :

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM**FORMAT OF CHECKING POWER CONSUMPTION OF MOTORS - AIR CONDITIONING PACKAGE**

SL No	Time in hr	Current in amps	Voltage in volts	Wattmeter reading	Actual power	Power factor	Remarks
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		RR - Y - B	RY RY - YB - RB	RR - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			

NTPC

CONTRACTOR

Appendix – V

Project :, STAGE-.... (...x.... MW)

Package: Air condition System COA No. :

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Motor make :

Location & application :

Guaranteed power cons. (as per LOA/Contract)

Dated of calibration of instrument and name of test :

Reading Set No :

Date :

FORMAT OF CHECKING POWER CONSUMPTION OF MOTORS - AIR CONDITIONING PACKAGE

SL No	Time in hr	Current in amps	Voltage in volts	Wattmeter reading	Actual power	Power factor	Remarks
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		RR - Y - B	RY RY - YB - RB	RR - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			

NTPC

CONTRACTOR

Appendix -III

Project :, STAGE-.... (...x..... MW)

Package: Air condition System COA No. :

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Motor make :

Location & application :

Guaranteed power cons. (as per LOA/Contract)

Dated of calibration of instrument and name of test :

Reading Set No :

Date :

FORMAT OF CHECKING POWER CONSUMPTION OF MOTORS - AIR CONDITIONING PACKAGE

SL No	Time in hr	Current in amps	Voltage in volts	Wattmeter reading	Actual power	Power factor	Remarks
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - YY - B	RY - YB YB - RB	R - YY - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			
		R - Y - B	RY - YB - RB	R - Y - B			

CLAUSE NO.

TECHNICAL REQUIREMENTS



NTPC

CONTRACTOR

FORMAT FOR RECORDING OF EQUIPMENT PARAMETERS

Appendix-IV

Project :....., STAGE-.... (...x..... MW)

Package: Air condition System COA No. :.....

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Date :

Area : MAIN POWER HOUSE

Instrument Used & SL No : .

Reading set no :

SL No	EQUIPMENT	Parameters	Reading 1	Reading 2	Reading 3	Reading 4
			Time :	Time :	Time :	Time :
1	CHILLER No :	Water temp. at inlet (°C)				
		Water temp. at outlet (°C)				
2	CHILLER No :	Water temp. at inlet (°C)				
		Water temp. at outlet (°C)				
3	CONDENSER No :	Water temp. at inlet (°C)				
		Water temp. at outlet (°C)				
4	CONDENSER No :	Water temp. at inlet (°C)				
		Water temp. at outlet (°C)				
5	CHILLED WATER PUMP No :	Pressure at suction (kg/cm ²)				
		Pressure at discharge (kg/cm ²)				
		Bearing temp. of motor (°C)				
		Rotating speed (RPM)				
		Full Load Current				
6	CHILLED WATER PUMP No :	Pressure at suction (kg/cm ²)				
		Pressure at discharge (kg/cm ²)				
		Bearing temp. of motor (°C)				
		Rotating speed (RPM)				
		Full Load Current				
		Pressure at discharge (kg/cm ²)				
		Bearing temp. of motor (°C)				
		Rotating speed (RPM)				
7	COOLING TOWER & FAN MOTOR No :	Inlet Temperature (°C)				
		Outlet Temperature (°C)				
		Flow through nozzle				
	COOLING TOWER & FAN MOTOR No :	Inlet Temperature (°C)				
		Outlet Temperature (°C)				

LARA SUPER THERMAL POWER PROJECT
STAGE-II (2X800 MW)
EPC PACKAGE

TECHNICAL SPECIFICATIONS
SECTION- VI, PART - B

SUB SECTION- G-04
STANDARD PG TEST
PROCEDURE

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CLAUSE NO.	TECHNICAL REQUIREMENTS					
		Flow through nozzle				
NTPC CONTRACTOR						
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION- VI, PART - B		SUB SECTION- G-04 STANDARD PG TEST PROCEDURE		Page 202 of 227

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TECHNICAL REQUIREMENTS



FORMAT FOR RECORDING VIBRATION LEVEL & NOISE LEVEL OF EQUIPMENT

Appendix - V

Project :, STAGE-.... (...x.... MW)

Package: Air condition System COA No. :

Contractor: Owner :NTPC Limited

Date :

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Instrument Used & SL No :

Reading set no : Area : MAIN POWER HOUSE

SL N o	EQUIPMENT	READING No	TIME	DISPLACEMENT IN MICRON (Acceptable value ----- microns)			NOISE LEVEL IN dBA (acceptable value ---- dBA)	RPM	REMARKS
				V	A	H			
1	AHU No :	1							
		2							
		3							
		4							
2	AHU No :	1							
		2							
		3							
		4							
3	AHU No :	1							
		2							
		3							
		4							
4	AHU No :	1							
		2							
		3							
		4							
5	AHU No :	1							
		2							
		3							
		4							
6	AHU No :	1							
		2							
		3							
		4							
7	AHU No :	1							
		2							
		3							
		4							
		2							
		3							
		4							
NTPC					CONTRACTOR				

LARA SUPER THERMAL POWER PROJECT
STAGE-II (2X800 MW)
EPC PACKAGE

TECHNICAL SPECIFICATIONS
SECTION- VI, PART - B

SUB SECTION- G-04
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PROCEDURE

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CLAUSE NO.

TECHNICAL REQUIREMENTS



FORMAT FOR RECORDING VIBRATION LEVEL & NOISE LEVEL OF EQUIPMENT

Appendix - V

Project :, STAGE-.... (...X.... MW)

Package: Air condition System COA No. :

Contractor: Owner :NTPC Limited

Date :

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Instrument Used & SL No :

Reading set no : Area : ESP CONTROL ROOM

SL No	EQUIPMENT	READING No	TIME	DISPLACEMENT IN MICRON (Acceptable value ----- microns)			NOISE LEVEL IN dBA (acceptable value ---- dBA)	RPM	REMARKS
				V	A	H			
1	AHU No :	1							
		2							
		3							
		4							
2	AHU No :	1							
		2							
		3							
		4							
3	AHU No :	1							
		2							
		3							
		4							
4	AHU No :	1							
		2							
		3							
		4							
5	AHU No :	1							
		2							
		3							
		4							
6	AHU No :	1							
		2							
		3							
		4							
7	AHU No :	1							
		2							
		3							
		4							
NTPC					CONTRACTOR				

LARA SUPER THERMAL POWER PROJECT
STAGE-II (2X800 MW)
EPC PACKAGE

TECHNICAL SPECIFICATIONS
SECTION- VI, PART - B

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PROCEDURE

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Appendix - VI

Project :, STAGE-.... (...x..... MW)

Package: Air condition System COA No. :.....

Contractor: Owner :NTPC Limited

Date :

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Instrument Used & SL No :

Reading set no : Area : ESP CONTROL ROOM

SL No	EQUIPMENT	READING No	TIME	Entering Air Parameters			Leaving air parameters		
				DB (C)	WB(C)	Enthalpy Kcal/Kg	DB (C)	WB(C)	Enthalpy Kcal/Kg
1	AHU No :	1							
		2							
		3							
		4							
2	AHU No :	1							
		2							
		3							
		4							
3	AHU No :	1							
		2							
		3							
		4							
4	AHU No :	1							
		2							
		3							
		4							
5	AHU No :	1							
		2							
		3							
		4							
6	AHU No :	1							
		2							
		3							
		4							
7	AHU No :	1							
		2							
		3							
		4							

NTPC

CONTRACTOR

CLAUSE NO.

TECHNICAL REQUIREMENTS



FORMAT FOR RECORDING VIBRATION LEVEL & NOISE LEVEL OF EQUIPMENT

Appendix -VII

Project :....., STAGE-.... (...x..... MW)

Package: Air condition System COA No. :.....

Contractor: Owner :NTPC Limited

STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM

Instrument Used & SL No :

Date :

Reading set no : Area : MAIN POWER HOUSE

SL No	EQUIPMENT	READING No	TIME	DISPLACEMENT IN MICRON (Acceptable value - ---- microns)			NOISE LEVEL IN dBA (acceptable value ---- dBA)	REMARKS
				V				
1	CHILLING UNIT No :	1						
		2						
		3						
		4						
2	CHILLING UNIT No :	1						
		2						
		3						
		4						
3	CHW PUMP No :	1						
		2						
		3						
		4						
4	CHW PUMP No :	1						
		2						
		3						
		4						
5	CHW PUMP No :	1						
		2						
		3						
		4						
6	CCW PUMP No :	1						
		2						
		3						
		4						

NTPC

CONTRACTOR

LARA SUPER THERMAL POWER PROJECT
STAGE-II (2X800 MW)
EPC PACKAGE

TECHNICAL SPECIFICATIONS
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STANDARD PG TEST
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Area : FORMAT FOR RECORDING VIBRATION LEVEL & NOISE LEVEL OF EQUIPMENT
Appendix-VIII
Project :, STAGE-.... (...x..... MW)
Package: Air condition System COA No. :
Contractor: Owner :NTPC Limited
STANDARD GUARANTEE AND ACCEPTANCE TEST PROCEDURE FOR AC SYSTEM
Instrument Used & SL No :
Date :
Reading set no : Area ESP & WSC BUILDING

SL No	EQUIPMENT	READING No	TIME	DISPLACEMENT IN MICRON (Acceptable value ----- microns)		NOISE LEVEL IN dBA (acceptable value ---- dBA)		REMARKS
				V				
1	COND. UNITS	1						
		2						
		3						
		4						
2	COND. UNITS	1						
		2						
		3						
		4						
NTPC				CONTRACTOR				

Note:

1. Vendor to sign /digitally sign and stamp on all pages of PG procedure.
2. Attachment 10 giving guaranteed parameters to be enclosed.
3. Relevant pages of Functional Guarantee & LD to be enclosed.
4. Relevant pages of Tech Specs to be enclosed.

CLAUSE NO.	TECHNICAL REQUIREMENTS		
PG TEST PROCEDURE FOR VENTILATION SYSTEM PACKAGE PROJECT : ----- SUPER THERMAL POWER PROJECT (-- X -- MW)			
OBJECTIVES OF THE TESTS:			
I.	To Verify the guarantee parameters.		
II.	To check healthy working of all the equipment forming the total Ventilation system.		
	Following parameters shall be measured during Guarantee Test.		
III..	D.B., W.B. temp. and saturation efficiency of Evaporative Cooling		
IV..	System and D.B and W.B temperature of UAF System during summer		
V.	Capacity of Centrifugal Fans		
VI.	Power Consumption of fans & pumps at rated capacity using watt meters. Current and voltage rating of motors shall also be recorded.		
VII.	Vibration & Noise Level of pumps and fans		
VIII.	Bearing Temp. of Motors, fans & pumps.		
IX.	Fan speed.		
X.	Pressure drop across air washer and UAF units.		
XI.	To check satisfactory operation of all electrical interlocks for each individual equipment and for the complete system.		
XII.	Performance test for Centrifugal & Axial flow (i.e. R. Exhauster, Propeller type Tube Axial fan etc.) Fans		
1. EQUIPMENT PERFORMANCE			
The plant should continuously run for two hours for stabilization of the system before commencement of taking measurement of different parameters.			
Following are the parameters to be recorded during equipment performance test:			
I.	Current and Voltage or Power drawn by motors.		
II.	Bearing temperature of motors, fans and pumps to be measured		
III.	Pressure developed by pumps shall be measured		
IV.	The Air flow quantity shall be calculated by measuring velocity with help of anemometer /velometer in front of suction filters in a direction perpendicular to filter planes and at 1” distance from the filter. Air Washer Room shall be closed while taking reading on Anemometer/Velometer. Velocity shall be measured at 5-7 transverse points across the filters to compute average velocity for flow calculations.		
Test Capacity (M³/sec) = Inlet Suction Area(M²) x Average Velocity (M/sec)			
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	V. Dry bulb temperature, Wet bulb temperature of entering air before the air washer and leaving air just after the eliminators. VI. Vibration and noise level of centrifugal fans and associated motors to be measured. The limit will be as per QAP/Relevant standard. VII. Fan speed by Tachometer .		
	2. CONDUCTANCE OF TEST i) Responsibility for conducting the test rests lies with Contractor. ii) Guarantee Test shall be conducted at site by representatives of Vendor and NTPC as per the procedure hereunder. Contractor shall be given permission to inspect the system in advance and make it ready for the test.		
	3. TEST INSTRUMENTS All instruments required for the test shall be arranged by Vendor free of cost. Calibration of test instruments shall be responsibility of Vendor. I. Calibration of instruments (to be used in the test) shall be carried out at an Govt./NABL approved test laboratory and calibration certificate of the instruments should be valid during the period of the test. II. Calibration certificate (in original) of all instruments shall be submitted to NTPC Site for approval. III. All the calibrated instruments shall be sealed after calibration at test lab and intactness of the seal shall be checked by NTPC before start of the test. IV. Bearing Temperature is to be measured using thermometers of ± 1 deg. C accuracy having least count of 0.5 deg. C. V. Online pressure gauges shall be used for recording the parameters of pumps. VI. Calibrated gauges of accuracy $\pm 0.5\%$ shall be used on water circuit for temperature & pressure measurements. VII. Air flow shall be measured using calibrated velometer / Anemometer. VIII. Dry bulb & Wet bulb temp shall be measured using sling psychrometer. The thermometers of psychrometer, shall be ± 0.5 deg. C accuracy with least count of 0.5 deg. C. IX. Wattmeter of $\pm 1.0\%$ accuracy class shall be used for power consumption measurement. X. Vibration & Noise level of motors, fans & pumps shall be measured by calibrated instruments. XI. Tachometer for R.P.M. measurement shall be of $\pm 1.0\%$ accuracy. XII. Manometer for pressure drop across filters. XIII. Voltage and current shall be measured using tong tester/Clamp meter of $\pm 1\%$ accuracy class. 4. PRE-REQUISITES TO THE GUARANTEE TEST I. All the installation / commissioning protocols in respect of alarm/ annunciation/ control system, pipeline flushing, vibration & noise level measurement data of motors, fans & pumps during		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 209 of 227

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	commissioning shall be made available during Guarantee Test by the contractor. II. All NTPC approved data sheets for the plant/system for which Guarantee Test is to be carried out shall be made available during the test. III. Uninterrupted power supply within specified parameters for the duration of the test shall be ensured by NTPC. IV. Proper lubrication and oil level of all equipment to be ensured. V. Cleanliness of Plant/System shall be ensured by NTPC. VI. Protection relays of switchgears and all motor feeders shall be checked. VII. Readiness of all protections, interlocks and safety switches to be ensured. Joint protocol in this respect shall be signed. VIII. Availability of suitable fire protection system/ fire fighting equipment to be ensured by NTPC during Guarantee Test. IX. Deputation of team to site to associate with the test to be ensured by the Contractor. X. Arrangement of all calibrated test instrument as per Cl. No. 2.02.00 to be ensured by the Contractor. XI. The plant/ system shall be jointly inspected by NTPC and the contractor and a joint protocol shall be signed that the plant is fit for conducting guarantee Test. 1 Successful completion of trial operation.		
	5.TEST METHODOLOGY		
	I. SATURATION EFFICIENCY OF AIR WASHER UNIT Before commencement of Guarantee Test of Air Washer System, the plant shall run for at least 2-3 hours for stabilization of system and all required adjustments shall be done by vendor till all guaranteed parameters are achieved. Also before start of test working of various mechanical/electrical parts to be checked visually and satisfactory operation of all electrical interlocks and controls to be checked. SATURATION EFFICIENCY shall be computed using following formula:- $\text{Saturation Efficiency} = \frac{T_e - T_1}{T_e - t_e} > \text{-----} \quad (\text{As per Technical Specification})$ Where,		
	Te = Dry Bulb temperature Entering Air Washer Unit. T1 = Dry Bulb Temperature leaving Air Washer Unit. te =Wet Bulb Temperature entering Air Washer Unit		
	Dry Bulb & Wet Bulb Temperature at Inlet & Outlet of Air Washer shall be measured by Sling Phychrometer. Sling Phychrometer reading will be taken through moving air and continued till thermometer reading becomes steady. The thermometer forming part of Sling Phychrometer shall be of $\pm 0.5\%$ accuracy with least count of 0.5 deg. C. II. In case of UAF units, Dry Bulb & Wet Bulb temperature at inlet and outlet of UAF unit shall be measured by sling phychrometer. III. VIBRATION & NOISE LEVEL Vibration of Centrifugal Fans and Pumps and Associated Motors shall be measured. Acceptance criterion for Vibrations and noise level shall be as per technical specification.		
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 210 of 227

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IV. BEARING TEMPERATURE Motor, Fan & Pump Bearing Temperature, wherever possible, shall be measured by Surface Contact. V. General Functional Test (Run Test) of all equipment shall be done at site.			
LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 211 of 227	

PROJECT: ---- THERMAL POWER STATION (---x ---MW) PACKAGE :

VENTILATION SYSTEM

P.G TEST LOG SHEET FOR AIR WASHER/UAF SYSTEM

Location/System :						
1	Velocity across Filter (M/Sec.)	A	B	C	D	E
		Average velocity (M/Sec.) =				
2	Area of Filter (M2)					
3	Pump (RPM)	Fan:			Pump :	
4	Current (Amp)	Fan Motor			Pump Motor	
		R			R	
		Y			Y	
		B			B	
5	Voltage (V)	Fan:			Pump :	
6	Bearing temp. Deg. C	Fan:			Pump :	
7	Dry bulb temp (Te)					
8	Wet bulb temp (te)					
9	Dry bulb temp (TI)					
10	Pump Discharge Pressure (Kg/cm2)					
11	Pressure drop across the Air washer (mm W.C)					
12	Noise (dBA)					
13	Vibration	V	H	A		



**1X800 MW SIPAT STPP (STAGE-III)
AIR CONDITIONING SYSTEM
PAINTING SPECIFICATIONS**

SPECIFICATION No: PE-TS-520-553-002-A001

SECTION : I

SUB-SECTION : C 2C

REV. 00

OCT 2025

SECTION: I

SUB-SECTION: C 2C

CUSTOMER SPECIFICATIONS

PAINTING SPECIFICATIONS

SUB-SECTION-A-12

SURFACE PREPARATION & PAINTING

**SIPAT SUPER THERMAL POWER PROJECT
STAGE-III (1X800 MW)
EPC PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-B
BID DOC. NO.**

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	Specification of surface preparation & painting			
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.			
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.			
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.			
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.			
1.05.00	SURFACE PREPARATION			
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.			
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.			
	SP1	Solvent cleaning		
	SP2	Application of rust converter (Ruskil or equivalent grade)		
	SP3	Power tool cleaning		
	SP4	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)		
	SP4*	Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns		
	SP5	Shot blasting/ abrasive blasting.		
	SP6	Emery sheet cleaning/Manual wire brush cleaning.		
1.06.00	APPLICATION OF PRIMER/PAINT			
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.			
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.			
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.			
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION VI, PART-B		SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING
Page 1 of 8				

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminum paint to IS 2339. PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC) PS13 - Rust preventive fluid by spray, dip or brush. PS14 - Weldable primer-Deoxaluminat or equivalent. PS16 - High Build Epoxy CDC mastic `15'. PS17 - Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=35.0(min.) PS-20 - Epoxy based finish paint			
1.06.06	All weld edge preparation for site welding shall be applied with one coat of wieldable primer.			
1.06.07	For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.			
1.06.08	SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.			
1.06.09	a) All un-insulated equipments, pipes, valves etc. covered in sub-section A-07 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 microns. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner: ▪ Primer coat – Epoxy based zinc phosphate ▪ Intermediate - Epoxy based TiO₂ pigmented coat ▪ Finish coat - Epoxy based finish coat/Two pack polyurethane coat b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 microns. c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard.			
1.06.10	A)	Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows: Primer : One coat of unmodified epoxy resin along with polyimide hardener. Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION VI, PART-B	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING	Page 2 of 8

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	hardener. Total thickness of primer and paint should not be less than 400 microns. B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows: i) For Indoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be done either manually or by any other approved method. (b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns. (c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns. (d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns. Total DFT of paint system shall not be less than 150 microns. ii) For Outdoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard. (b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided. The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION VI, PART-B	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING	Page 3 of 8	



1.06.11 Primer/Painting Schedule

Sl. No	Description	Surface Preparation	Primer Coat		Intermediate Coat		Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade		
			Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping													
1.	All insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	As per NTPC Colour shade/ coding scheme
2.	All un-insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipment etc.	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3	35 \$	155 \$	
		SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)	SP4*	PS19	1	40	-	-	-	PS9*	1	20	40	
4	Piping hangers / supports (other than (3) above. (un-insulated)	SP3/SP5	PS5	2	25	-	-	-	PS4	2	25	100	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION VI, PART-B				SUB-SECTION -A-12 SURFACE PREPARATION & PAINTING			Page 4 of 8				



Valves													
		Design temperature < or equal to 60 degC	SP3/SP5	PS5	2	35	-	-	-	PS4	2	25	120
5.	Cast/Forged	Design temperature above 60 degC	SP3/SP5	PS9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a) Epoxy coat	2	35	250
										b) Final coat of paint PS17	1	30	
7.	Weld Edges	Within building	SP4*	-do-	1	35	PS18	1	35	a) Epoxy coat	2	25	150
										b) Final coat of paint PS17	1	30	
			SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25

SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION VI, PART-B	SUB-SECTION -A-12 SURFACE PREPARATION & PAINTING	Page 5 of 8
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1. \$ - The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site. 2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint. 3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable. 4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme. 5. For corrosion protection, all inner parts of the hangers (CLH/VLH) shall be at least in full compliance to Corrosion category C3 as per EN ISO12944. 6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable.												
B) Steam Generator & Auxiliaries:												
1	All surfaces with temperature 95°C or less and which are insulated	SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 \$	20 \$	100 \$
2	All surfaces with temperature above 95°C and which are insulated	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40

Note: 1) SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

2) Painting specification for all other exposed steel surfaces not covered above shall be same as that given in Civil Sub-section, Part-B, Section VI for corrosion protection of steel structures.

SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION VI, PART-B	SUB-SECTION -A-12 SURFACE PREPARATION & PAINTING	Page 6 of 8
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C) LOW PRESSURE PIPING													
1	All Piping, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Color shade/ coding scheme.
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											
D) Fire Detection & Protection System, Compressed air system and Air-conditioning & Ventilation System													
For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System													
For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System.													
For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Ventilation System.													
For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section--A-16 compressed air system.													
E) ESP													
1	All surfaces with surface temperature 95°C or less (with or without insulation)	SP3/SP4	PS3/ PS3*	1	25	-	-	-	-	PS 4	1	30	55
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	-	60

SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION VI, PART-B	SUB-SECTION -A-12 SURFACE PREPARATION & PAINTING	Page 7 of 8
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General Notes (Applicable for all above points A to E)

- i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.
- ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System	
(i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard. (ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.	

SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION VI, PART-B	SUB-SECTION -A-12 SURFACE PREPARATION & PAINTING	Page 8 of 8
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**1X800 MW SIPAT STPP (STAGE-III)
HVAC SYSTEM
TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**

SPECIFICATION No: PE-TS-520-553-002-A001

SECTION : I

SUB-SECTION : C-3

REV. 00

OCT 2025

SECTION: I

SUB-SECTION: C-3

TECHNICAL SPECIFICATION (ELECTRICAL PORTION)



TITLE:

**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
HVAC SYSTEM****1X 800MW SIPAT SUPER THERMAL POWER
PROJECT STAGE-III EPC PACKAGE**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **C**REV NO. : **00** DATE: 05/06/2025

SHEET: 1 OF 1

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SECTION	TITLE	NO OF SHEETS
C	SPECIFIC TECHNICAL REQUIREMENTS	1
C	ELECTRICAL SCOPE BETWEEN BHEL & VENDOR	2
C	TECHNICAL SPECIFICATION FOR MOTORS	5
C	TENTATIVE MAKE LIST OF ELECTRICAL ITEMS	4
D	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	5
D	MOTOR DATASHEET-C	7
D	VFD	12
D	QUALITY PLAN (FOR MOTORS BELOW 50 KW)	2
D	QUALITY PLAN (FOR MOTORS ABOVE & 50 KW)	2
D	LOAD DATA & CABLE LISTING FORMAT	4



**TECHNICAL SPECIFICATION FOR
HVAC SYSTEM
(ELECTRICAL PORTION)**

SPECIFICATION NO. PE-TS-XXX-XXX-AXXX
VOLUME II B
REV 01 DATE 05.06.2025
PAGE 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

- 1.0 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-I [Scope of Work (Electrical)].
- 2.0 Make of all electrical equipment/ items supplied shall be reputed make. Same shall be subject to approval of BHEL/customer after award of contract without any commercial implications. Tentative make list of various Electrical items (Motors/ lugs/glands) is attached.
- 3.0 All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

4.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 4.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated.
- 4.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

5.0 LIST OF ENCLOSURES

- 5.1 Electrical scope between BHEL & vendor
- 5.2 Technical specification - Motors.
- 5.3 VFD specification
- 5.4 Datasheets –Motor
- 5.5 Quality Plan for motors.
- 5.6 Load data format
- 5.7 Tentative make list for electrical items (motor, lugs, glands)
- 5.8 Explanatory note for Cable routing & Cable schedule format

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: HVAC SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	a) Normal 240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL as per load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. b) Emergency supply feeder provided (if required) shall be 3 phase 3 wire only. Any other voltage level (AC/DC/Single ph emergency AC) required will be derived by the vendor. c) 230 V AC UPS Power supply shall be provided by BHEL at a single point, All necessary hardware for deriving other power supply from given feeder shall be in Vendor's scope.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
5	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL BHEL	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
6	Cable glands ,lugs and bimetallic washers for equipment supplied by Vendor	Vendor	Vendor	Bimetallic washers shall be used for bimetallic connections.
7	Conduit and conduit accessories for cabling between equipment supplied by vendor	BHEL	Vendor	
8	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: HVAC SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	
13	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination

	TECHNICAL SPECIFICATION HVAC SYSTEM		PE-TS-XXX-YYY-HZZZ	
	1X 800MW SIPAT SUPER THERMAL POWER PROJECT STAGE-III EPC PACKAGE		Issue No: 00	
			Rev. No. 00	
			Date :	
TECHNICAL DATA - PART - A				
SL.NO	DESCRIPTION	UOM	DETAIL	
1.0	DESIGN CODES & STANDARDS			
1.1	Three phase induction motors :		IS15999, IEC:60034, IS: 12615, IS: 325	
1.2	Energy Efficient motors		IS 12615, IEC:60034-30	
1.3	Mechanical Vibration of Rotating Electrical Machines with Shaft Heights 56 mm and Higher - Measurement, Evaluation and Limits of Vibration Severity		IS 12075/IEC 60034-14	
1.4	Designation of Methods of Cooling of Rotating Electrical Machines		IS 6362	
1.5	Designation for types of construction and mounting arrangement of rotating electrical machines		IS 2253	
2.0	DESIGN /SYSTEM PARAMETERS			
2.1	Rated voltage	V	415	
2.2	Frequency	Hz	50	
2.3	Permissible variations for			
a)	Voltage	%	+/-10	
b)	Frequency	%	(+)3 to (-)5	
c)	Combined	%	10 (absolute sum)	
2.4	System fault level at rated voltage for 1 sec	kA	50	
2.5	Short time rating for terminal boxes for 0.25 sec	kA	50	
2.6	Type of motors		Squirrel cage induction motor	
a)	Non-VFD		Suitable for direct on line starting	
b)	VFD (if applicable)		Suitable for inverter duty	
2.7	Efficiency class			
a)	Output rating (at 50 deg.C ambient temperature)		Efficiency class	
i)	upto 50 KW		IE4	
ii)	50- 200 KW		IE3	
2.8	Rating			
a)	Motor duty		Continuously rated-S1	
b)	Design margin over continous max. demand of the driven equipment (min)		10%	
3.0	CONSTRUCTION FEATURES			
3.1	Winding		Electrolytic grade copper conductor	
3.2	Enclosure Details			
a)	Degree of protection			
i)	Indoor application		IP 55	
ii)	Outdoor application		IP 55 (Additional Canopy to be provided)	
b)	Method of ventilation		Totally enclosed fan cooled (TEFC) type	
3.3	Insulation			
a)	Class		'F' with temperature rise limited to class 'B'	
b)	General Characteristics		Non-hygroscopic, oil resistant, flame resistant	
c)	Special Characteristics		VPI insulation for VFD motors	
3.4	Bearings			
a)	Horizontal motors		Grease lubricated ball or roller bearings	
b)	Vertical motors		Grease lubricated ball or roller bearings or combined thrust and guide beaing	

3.5	Main terminal box		
a)	Type		Detachable type
b)	Location		In accordance with Indian Standards clearing the motor base-plate/ foundation
c)	Terminals		Stud or lead wire type, substantially constructed and thoroughly insulated from the frame
d)	Markings		Phase markings on terminals and direction of rotation marked on the non-driving end
e)	DOP		Same as motor
f)	Position when viewed from the non driving end		Left hand side
g)	Rotation		90 Deg.
h)	Space heater (for ratings 30 kW and above)		Suitable for 240V, 50Hz 1 ph AC. Separate terminal box provided for space heaters.
f)	Cable glands/lugs/gland plates		
i)	Size		As per cable size used
ii)	Lugs		Solderless crimping type heavy duty (Aluminium lugs for Aluminium cables and copper lugs for copper cables)
iii)	Glands		Double compression Ni-Cr plated brass glands
iv)	Gland plate thickness		3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables)
3.6	Earthing points		
a)	No. of points on motor body		Two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
b)	No. of points on motor terminal box		One earthing point complete with tapped holes, GI bolts and washers.
c)	Earthing Flat size		
i)	LT Motors above 125 KW		50 x 6mm GS flat
ii)	25 KW to 125 KW		25 x 6mm GS flat
iii)	1KW to 25 KW		25 x 3mm GS flat
iv)	Fractional kW		8 SWG GS Wire
3.7	Painting		Corrosion proof epoxy based paint with suitable additives to be used.
a)	Paint shade		RAL 5012 (Blue)
b)	Thickness of paint		The thickness of finish coat shall be minimum 50 microns (minimum total DFT 100 microns).
3.8	Minimum spacing between gland plate & centre of bottom terminal stud		
a)	UP to 3 KW		As per manufacturer's practice,
b)	Above 3 KW - upto 7 KW		85 mm
c)	Above 7 KW - upto 13 KW		115 mm
d)	Above 13 KW - upto 24 KW		167 mm
e)	Above 24 KW - upto 37 KW		196 mm
f)	Above 37 KW - upto 55 KW		249 mm
g)	Above 55 KW - upto 90 KW		277 mm
h)	Above 90 KW - upto 125 KW		331 mm
i)	Above 125 KW-upto 200 KW		385/203 (For Single core cables only) mm
3.9	Minimum inter-phase and phase-earth air clearances with lugs installed		
a)	UP to 110 KW		10mm
b)	Above 110 KW and upto 150 KW		12.5mm
c)	Above 150 KW		19mm

4.0	PERFORMANCE PARAMETERS		
4.1	Starting requirement		
a)	Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto rated speed		a) Up to 85% of rated voltage for ratings below 110 KW b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW
b)	Maximum locked rotor current		As per IS 12615
c)	Starting duty		Two hot starts in succession, with motor initially at normal running temperature.
d)	The locked rotor withstand time		Speed switches mounted on the motor shaft shall be provided in cases where below requirements are not met.
	Starting time of motors at minimum permissible voltage during starting		The locked rotor withstand time under hot condition at highest voltage limit
i)	upto 20 secs.		atleast 2.5 secs. more than starting time
ii)	more than 20 secs. and upto 45 secs		atleast 5 secs. more than starting time
iii)	more than 45 secs.		more than starting time by at least 10% of the starting time
e)	Ratio of locked rotor KVA at rated voltage to rated KW (max.)		
i)	Below 110KW		10
ii)	From 110 KW & upto 200 KW		9
4.2	Torque		
a)	Accelerating torque at any speed with the lowest permissible starting voltage		at least 10% motor full load torque
b)	Pull out torque at rated voltage		at least 205% of full load torque
4.3	Noise level (max.)		85 dB(A)
4.4	Vibration limits		As per IS 12075
5.0	INSPECTION/TESTING		
5.1	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED. The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only. 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as mentioned above.) 10. Test for degree of protection and 11. Overspeed test.		
5.2	The type test listed above should have been conducted within 10 yrs prior to supply under this contract. In absence of type tests reports or in case reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.		
5.3	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.		
5.4	All acceptance and routine tests as per the specification and relevant standards shall be carried out.Charges for these shall be deemed to be included in the equipment price.		
5.5	For motor rating upto 50 KW, BHEL QP No, PE-QP-999-Q-006 Rev 02 is to be followed. For motor ratings above 50 kW NTPC Quality assurance plan will be followed.		

d)	The locked rotor withstand time		Speed switches mounted on the motor shaft shall be provided in cases where below requirements are not met.
	Starting time of motors at minimum permissible voltage during starting		The locked rotor withstand time under hot condition at highest voltage limit
i)	upto 20 secs.		atleast 2.5 secs. more than starting time
ii)	more than 20 secs. and upto 45 secs		atleast 5 secs. more than starting time
iii)	more than 45 secs.		more than starting time by at least 10% of the starting time
e)	Ratio of locked rotor KVA at rated voltage to rated KW (max.)		
i)	Below 110 KW		10
ii)	From 110 KW & upto 200 KW		9
4.2	Torque		
a)	Accelerating torque at any speed with the lowest permissible starting voltage		at least 10% motor full load torque
b)	Pull out torque at rated voltage		at least 205% of full load torque
4.3	Noise level (max.)		85 dB(A)
4.4	Vibration limits		As per IS 12075
5.0	INSPECTION/TESTING		
5.1	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED. The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only. 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as mentioned above.) 10. Test for degree of protection and 11. Overspeed test.		
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FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

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1.0

INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer’s work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0

CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0

DESIGN REQUIREMENTS

3.1

Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2

Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3

Starting Requirements

3.3.1

Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2

Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply		
i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.		
ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)		
iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.		
Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		