







CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
23.01.01	<p>Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.</p> <p>The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.</p> <p>The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.</p>		
23.02.00	<p>Typical contents of QA Documentation is as below:-</p> <ul style="list-style-type: none"> (a.) Quality Plan (b.) Material mill test reports on components as specified by the specification and approved Quality Plans. (c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans. (d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment. (e.) Heat Treatment Certificate/Record (Time- temperature Chart) (f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure). (g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points. (h.) Certificate of Conformance (COC) wherever applicable. (i.) MDCC 		
23.03.00	<p>Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.</p>		
23.04.00	<p>Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The</p>		
<p align="center">LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 33 OF 83</p>


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	<p>supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.</p> <p>(a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.</p> <p>(b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.</p> <p>(c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.</p>			
23.05.00	<p>TRANSMISSION OF QA DOCUMENTATION</p> <p>On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.</p> <p>For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.</p>			
24.00.00	<p>PROJECT MANAGER'S SUPERVISION</p>			
24.01.00	<p>To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.</p>			
24.02.00	<p>The work shall be performed under the supervision of the Project Manager.</p> <p>The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:</p>			
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	<p>(a.) Interpretation of all the terms and conditions of these documents and specifications</p> <p>(b.) Review and interpretation of all the Contractor's drawing, engineering data, etc</p> <p>(c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract</p> <p>(d.) Inspect, accept or reject any equipment, material and work under the contract</p> <p>(e.) Issue certificate of acceptance and/or progressive payment and final payment certificates</p> <p>(f.) Review and suggest modifications and improvement in completion schedules from time to time, and</p> <p>(g.) Supervise Quality Assurance Programme implementation at all stages of the works.</p>		
25.00.00	INSPECTION, TESTING AND INSPECTION CERTIFICATES		
25.01.00	The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.		
25.02.00	The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.		
25.03.00	The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two		
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25.04.00	<p>(2) copies.</p> <p>The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.</p>			
25.05.00	<p>When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.</p>			
25.06.00	<p>In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.</p>			
25.07.00	<p>The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.</p>			
25.08.00	<p>To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 25.03.00 of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.</p>			
25.09.00	<p>All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.</p>			
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25.10.00	Associated document for Quality Assurance programme		
25.10.01	Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at Annexure-I.		
25.10.02	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at Annexure-II.		
25.10.03	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 (Annexure-III).		
25.10.04	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at Annexure-IV.		
25.10.05	Field Welding Schedule Format enclosed at Annexure-V.		
25.11.00	Not Used		
25.12.00	DEMONSTRATION OF APPLICATION ENGINEERING		
25.12.01	<p>Based on NTPC inputs, the Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following.</p> <p>(i) Logics/Loops:</p> <ul style="list-style-type: none"> 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. <p>(ii) HMI Functions:</p> <ul style="list-style-type: none"> a) LVS Annunciation. b) Graphics. c) HSR d) Logs/Reports. 		
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	<p style="text-align: center;">e) Calculations (Basic & Performance Calculations).</p>			
25.12.02	<p>The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.</p> <p>After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor based on NTPC inputs. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations in a format to be provided by the Employer and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.</p>			
25.12.03	<p>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.</p>			
26.00.00	<p>PRE-COMMISSIONING AND COMMISSIONING FACILITIES</p>			
26.01.00	<p>(a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications.</p> <p>(b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.</p> <p>(c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness.</p>			
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26.01.00	<p>(d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.</p> <p>(e) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs(standard check list)/TS(testing schedule)/CS(commissioning schedule)] approved by the employer.</p> <p>(f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.</p> <p>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:</p> <p>(1.) Biodata including experience of the Commissioning Engineers.</p> <p>(2.) Role and responsibilities of the Commissioning Organisation members.</p> <p>(3.) Expected duration of posting of the above Commissioning Engineers at site.</p>			
26.02.00	<p>Initial Operation</p> <p>(a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.</p> <p>(b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the FGD System shall operate continuously at full load for a period not less than 72 hours.</p> <p>The Initial Operation shall be considered successful, provided that each item/part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.</p>			
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26.03.00	<p>The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.</p> <p>(c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation.</p> <p>(d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.</p> <p>Guarantee Tests</p> <p>a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up and initial operation shall make the unit ready to conduct such test. Such test will be commenced, within a period of <u>three (3) months</u> after the successful completion of Initial Operations. Any extension of time beyond the above <u>three (3) months</u> shall be mutually agreed upon.</p> <p>b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.</p> <p>c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.</p> <p>d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.</p>			
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	e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.			
27.00.00	TAKING OVER Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be 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			
28.01.00	Training for Employers O&M Personnel The scope of service under training of Employer's engineers shall include a training module covering upto six (6) man months in the areas of Operation & Maintenance. Such training should enable the personnel to individually take the responsibility of operating and maintaining the FGD system in a manner acceptable to the Employer.			
28.02.00	Training for Employers Engineering Personnel The scope of services under training for Employer's engineering personnel shall also necessarily include two (2) manmonth. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. An indicative module of the training requirement of Employer's Engineering personnel is attached as Annexure-VII.			
28.03.00	Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Employer's approval. Consolidated training period included above {i.e. 6 man months (7 man months in case of projects where ZLD system is included in scope) and 3 man months (4 man months in case of projects where ZLD system is included in scope) respectively for O&M and			
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	<p>Engineering) is indicative only. Employer reserves the right to re appropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.</p>	
28.04.00	<p>Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.</p>	
28.05.00	<p>In all the above cases, wherever the training of Employer's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Employer's personnel shall be at the cost of Contractor. The Contractor shall make all necessary arrangements towards the same.</p>	
28.06.00	<p>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.</p> <p>Note: For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.</p>	
29.00.00	<p>SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION</p> <p>In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:</p> <ul style="list-style-type: none"> i) Working platforms should be fenced and shall have means of access. ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection. 	
30.00.00	<p>NOISE LEVEL</p> <p>The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA . However for Ball Mills the noise levels as per following shall also be acceptable:</p> <ul style="list-style-type: none"> a) Ball Mill < 90 dBA 	
31.00.00	<p>PACKAGING AND TRANSPORTATION</p> <p>All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the</p>	
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	<p>time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.</p> <p>32.00.00 ELECTRICAL EQUIPMENTS/ENCLOSURES</p> <p>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.</p> <p>33.00.00 INSTRUMENTATION AND CONTROL</p> <p>All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.</p> <p>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.</p> <p>All scales and charts shall be calibrated and printed in Metric Units as follows:</p> <table border="0"> <tr> <td>1. Temperature</td> <td>- Degree centigrade (deg C)</td> </tr> <tr> <td>2. Pressure</td> <td>- Kilograms per square centimetre (Kg/cm²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.</td> </tr> <tr> <td>3. Draught</td> <td>- Millimetres of water column (mm wc).</td> </tr> <tr> <td>4. Vacuum</td> <td>- Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).</td> </tr> <tr> <td>5. Flow (Gas)</td> <td>- Tonnes/ hour</td> </tr> </table>		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
1. Temperature	- Degree centigrade (deg C)											
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	<p>6. Flow (Steam) - Tonnes/ hour</p> <p>7. Flow (Liquid) - Tonnes / hour</p> <p>8. Flow base - 760 mm Hg. 0 deg.C</p> <p>9. Density - Grams per cubic centimeter.</p>		
33.02.00	<p>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.</p>		
33.03.00	<p>All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.</p>		
34.00.00	<p>ELECTRICAL NOISE CONTROL</p> <p>The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).</p>		
35.00.00	<p>SURGE PROTECTION FOR SOLID STATE EQUIPMENT</p> <p>All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.</p>		
36.00.00	<p>INSTRUMENT AIR SYSTEM</p> <p>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.</p> <p>Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.</p>		
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37.00.00	<p>TAPPING POINTS FOR MEASUREMENTS</p> <p>Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.</p> <p>For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted.</p> <p>The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.</p> <ul style="list-style-type: none"> i) Temperature test pockets with stub and thermowell ii) Pressure test pockets 			
38.00.00	<p>SYSTEM DOCUMENTATION</p> <p>The Bidder shall provide drawings, system overview & description, hardware/software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for control system shall include as a minimum to that specified elsewhere in the Technical Specification.</p> <p>The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.</p>			
38.01.00	<p>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.</p>			
39.00.00	<p>MAINTENANCE MANUALS OF ELECTRONIC MODULES</p> <p>The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and 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</p>			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>connection drawings etc as required to do the testing and maintenance of the electronic modules.</p>			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
LIST OF CODES AND STANDARDS				
	Indian Standards	Title	International and Internationally recognised standards	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)		
IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings		BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965	
IS:2825	Code for unfired vessels			
IS:1520	Horizontal centrifugal pumps for clear cold and fresh water			
IS:1600	Code for practice for performance of constant speed IC Engines for general purpose			
IS:1601	Specification for performance of constant speed IC Engines for general Purpose			
IS:1893	Criteria for earthquake resistant design of structures			
IS1978-1971	Line Pipe April 1969.		API Standards 5L	
IS:2254-1970	Dimensions of vertical shaft motor for pumps		IEC Pub 72-1 part I NEMA Pub MG 1 1954	
IS:2266	Steel wire ropes for general engineering purposes		BS :302 : 1968	
IS:2312	Propellant type Ventilation fans			
IS:2365	Steel wire suspension ropes for lifts and hoists		BS : 1957	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963	
IS:3354	Outline dimensions for electric lifts.		
IS:3401	Silica gel		
IS:3588	Specification for electrical axial flow fans		
IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)		
IS:3677	Unbonded rock and slag wool for thermal insulation		
IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)	
IS:3895	Specification for monocrystallines semiconductor rectifier cells and stacks		
IS:3963	Roof extractor unit		
IS:3975	Mild steel wires, strips and tapes for armoring cables		
IS:4503	Shell and tube type heat Exchanger		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 49 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS:4540	Specification for monory-stallines rectifire assembly equipment		
IS:4671	Expanded polystyrene for thermal insulation purpose		
IS:4736	Hot dip zinc coating on steel tubes		
IS:4894	Centrifugal fans		
IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)		
IS:5749	Forged ramshom hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958	
IS:6392	Steel pipe flanges	BS 4504 : 1969	
IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956	
IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524	
IS:7373	Specification for wrought aluminium and aluminium sheet and strips		
IS:7938	Air receivers for compressed air installation		
ISO:1217	Displacement compressor-Acceptance test		
ASHRAE-33 and air heating coils.	Methods of testing for rating of forced circulation air cooling		
ASHRAE-52-76	Air cleaning device used in general ventilation for removing particle matter.		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 50 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers.</p> <p>ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors.</p> <p>ARI-450-6 Standard for water cooled refrigerant condensers.</p> <p>ARI-550 Standard for centrifugal water chilling packages.</p> <p>ARI-410 Standard for forced circulation air cooling and air heating coils</p> <p>ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 Fans (Part-1,2)</p> <p>BS:400 Low carbon steel cylinders for the storage & transport of permanent gases.</p> <p>BS:401 Low carbon steel cylinders for the storage & transport of liquified gases.</p> <p>CTI Code Acceptance test code for Water Cooling Tower. ACT-105</p> <p>ANSI-31.5 Refrigerant piping</p> <p>ASME-PTC- Atmospheric Water Cooling Equipment 23-1958</p> <p>AMCA A-21C Test Code for air moving devices</p> <p>API:618 Reciprocating Compressor for general refinery services.</p> <p>HYDRAULIC INSTITUTE STANDARDS.</p> <p>HYDRANT SYSTEM MANUALS OF TAC.</p> <p>TAC MANUALS OF SPRAY SYSTEM</p> <p>NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.</p> <p>INDIAN EXPLOSIVES ACT.</p> <p>INDIAN FACTORIES ACT.</p> <p>STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.</p>		
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 51 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>CODE AND STANDARD FOR CIVIL WORKS</p> <p>Some of the applicable Standards, Codes and references are as follows:</p> <p>Excavation & Filling</p> <p>IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.</p> <p>IS: 4701 Code of practice for earth work on canals.</p> <p>IS: 9758 Guide lines for Dewatering during construction.</p> <p>IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.</p> <p>Properties, Storage and Handling of Common Building Materials</p> <p>IS: 269 Specification for ordinary Portland cement, 33 grade.</p> <p>IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.</p> <p>IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.</p> <p>IS: 455 Specification for Portland slag cement.</p> <p>IS: 702 Specification for Industrial bitumen.</p> <p>IS: 712 Specification for building limes.</p> <p>IS: 808 Rolled steel Beam channel and angle sections.</p> <p>IS: 1077 Specification for common burnt clay building bricks.</p> <p>IS: 1161 Specification of steel tubes for structural purposes.</p> <p>IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C.</p> <p>IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B.</p> <p>IS: 1367 Technical supply conditions for Threaded fasteners.</p> <p>IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based.</p>			
<p align="center">LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 52 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part-II) IS: 1542 IS: 1566 IS: 1786 IS: 2062 IS: 2116 IS: 2386 (Parts-I to VIII) IS: 3150 IS: 3495 (Parts-I to IV) IS: 3812 IS: 4031 IS: 4032 IS: 4082 IS: 8112 IS: 8500 IS: 12269 IS: 12894 Cast-In-Situ Concrete and Allied Works IS: 280 IS: 456	Calcined clay based. Specification for sand for plaster. Specification for hard-drawn steel wire fabric for concrete reinforcement. Specification for high strength deformed bars for concrete reinforcement. Specification for steel for general structural purposes. Specification for sand for masonry mortars. Testing of aggregates for concrete. Hexagonal wire netting for general purpose. Methods of tests of burnt clay building bricks. Specification for fly ash, for use as pozzolana and admixture. Methods of physical tests for hydraulic cement. Methods of chemical analysis of hydraulic cement. Recommendations on stacking and storage of construction materials at site. Specification for 43 grade ordinary portland cement. Medium and high strength structural steel. 53 grade ordinary portland cement. Specification for Fly ash lime bricks. Specification for mild steel wire for general engineering purposes. Code of practice for plain and reinforced concrete.	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 53 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.	IS: 516	Method of test for strength of concrete.	
IS: 650		Specification for standard sand for testing of cement.		IS: 1199
IS: 1791	General requirements for batch type concrete mixers.		IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).
IS: 2204		Code of practice for construction of reinforced concrete shell roof.	IS: 2210	
IS: 2438	Specification for roller pan mixer.		IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
IS: 2505		General requirements for concrete vibrators, immersion type.	IS: 2506	
IS: 2514	Specification for concrete vibrating tables.		IS: 2645	Specification for Integral cement water proofing compounds.
IS: 2722		Specification for portable swing weigh batches for concrete. (single and double bucket type)	IS: 2750	
IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.		IS: 3025	Methods of sampling and test waste water.
IS: 3366		Specification for Pan vibrators.	IS: 3370	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE			TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part I to IV) IS: 3414 IS: 3550 IS: 3558 concrete. IS: 4014 (Parts I & II) IS: 4326 of buildings. IS: 4461 IS: 4656 IS: 4925 IS: 4990 IS: 4995 (Parts I & II) IS: 5256 IS: 5525 concrete work. IS: 5624 IS: 6461 IS: 6494 IS: 6509 IS: 7861 IS: 9012 IS: 9103	liquids. Code of practice for design and installation of joints in buildings. Methods of test for routine control for water used in industry. Code of practice for use of immersion vibrators for consolidating concrete. Code of practice for steel tubular scaffolding. Code of practice for earthquake resistant design and construction of buildings. Code of practice for joints in surface hydro-electric power stations. Specification for form vibrators for concrete. Specification for batching and mixing plant. Specification for plywood for concrete shuttering work. Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. Code or practice for sealing joints in concrete lining on canals. Recommendations for detailing of reinforcement in reinforced concrete work. Specification for foundation bolts. Glossary of terms relating to cement concrete. Code of practice for water proofing of underground water reservoirs and swimming pools. Code of practice for installation of joints in concrete pavements. Code of practice for extreme weather concreting. (Parts I & II) Recommended practice for shot concreting. Specification for admixtures for concrete.	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 55 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS: 9417		Recommendations for welding cold worked steel bars for reinforced concrete construction.	
IS: 10262		Recommended guidelines for concrete mix design.	
IS: 11384		Code of practice for composite construction in structural steel and concrete.	
IS: 11504		Criteria for structural design of reinforced concrete natural draught cooling towers.	
IS: 12118		Specification for two-parts poly sulphide.	
IS: 12200		Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.	
IS: 13311		Method of non-destructive testing of concrete.	
Part-1		Ultrasonic pulse velocity.	
Part-2		Rebound hammer.	
SP:23		Handbook of concrete mixes	
SP: 24		Explanatory Handbook on IS: 456-1978	
SP: 34		Handbook on concrete reinforcement and detailing.	
		Precast Concrete Works	
SP: 7(PartVI/		National Building Code- Structural design of prefabrication and Sec.7) systems building.	
IS: 10297		Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.	
IS: 10505		Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.	
		Masonry and Allied Works	
IS: 1905		Code of Practice for Structural Safety of Buildings-Masonry walls.	
IS: 2212		Code of Practice for Brickwork.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.	
	SP: 20	Explanatory hand book on masonry code.	
	Sheeting Works		
	IS:277	Galvanised steel sheets (plain or corrugated).	
	IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.	
	IS: 513	Cold-rolled carbon steel sheets.	
	IS: 730	Specification for fixing accessories for corrugated sheet roofing.	
	IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.	
	IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.	
	IS: 3007	Code of practice for laying of asbestos cement sheets.	
	IS: 5913	Methods of test for asbestos cement products.	
	IS: 7178	Technical supply conditions for tapping screw.	
	IS: 8183	Bonded mineral wool.	
	IS: 8869	Washers for corrugated sheet roofing.	
	IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.	
	IS: 12866	Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced).	
	IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.	
	Fabrication and Erection of Structural Steel Work		
	IS: 2016	Specification for plain washers.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.		
IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.		
IS: 3502	Specifications for chequered plate.		
IS: 6911	Specification for stainless steel plate, sheet and strip.		
IS: 3757	Specification for high strength structural bolts		
IS: 6623	Specification for high strength structural nuts.		
IS: 6649	High Tensile friction grip washers.		
IS: 800	Code of practice for use of structural steel in general building construction.		
IS: 816	Code of practice for use of Metal Arc Welding for General Construction.		
IS: 4000	Code of practice for assembly of structural joints using high tensile friction grip fasteners.		
IS: 9595	Code of procedure of Manual Metal Arc Welding of Mild Steel.		
IS: 817	Code of practice for Training and Testing of Metal Arc Welders.		
IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).		
IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.		
IS: 9006	Recommended Practice for Welding of Clad Steel.		
IS: 7215	Tolerances for fabrication steel structures.		
IS: 12843	Tolerance for erection of structural steel.		
IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.		
SP: 6 (Part 1 to 7)	ISI Hand book for structural Engineers.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.		
IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube		
IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.		
IS : 2595	Code of Practice for Radio graphic testing.		
IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.		
IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.		
IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.		
IS : 3658	Code of practice for Liquid penetrant Flaw Detection.		
IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.		
Plastering and Allied Works			
IS : 1635	Code of practice for field slaking of Building lime and preparation of putty.		
IS : 1661	Application of cement and cement lime plaster finishes.		
IS : 2333	Plaster-of-paris.		
IS : 2402	Code of practice for external rendered finishes.		
IS : 2547	Gypsum building plaster.		
IS : 3150	Hexagonal wire netting for general purpose.		
Acid and Alkali Resistant Lining			
IS : 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.		
IS : 412	Specification for expanded metal steel sheets for general purpose.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
IS : 4441	Code of practice for use of silicate type chemical resistant mortars.		
IS : 4443	Code of practice for use of resin type chemical resistant mortars.		
IS : 4456	Method of test for chemical resistant tiles. (Part I & II)		
IS : 4457	Specification for ceramic unglazed vitreous acid resistant tiles.		
IS : 4832	Specification for chemical resistant mortars.		
	Part I Silicate type		
	Part II Resin type		
	Part III Sulphur type		
IS : 4860	Specification for acid resistant bricks.		
IS : 9510	Specification for bitumasitc, Acid resisting grade.		
Water Supply, Drainage and Sanitation			
IS : 458	Specification for concrete pipes.		
IS : 554	Dimensions for pipe threads, where pressure tight joints are made on thread.		
IS : 651	Specification for salt glazed stoneware pipes.		
IS : 774	Flushing cisterns for water closets and urinals.		
IS : 775	Cast iron brackets and supports for wash basins and sinks.		
IS : 778	Copper alloy gate, globe and check valves for water works purposes.		
IS : 781	Cast copper alloy screw down bib taps and stop valves for water services.		
IS : 782	Caulking lead.		
IS : 783	Code of practice for laying of concrete pipes.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS : 1172	Basic requirements for water supply, drainage and sanitation.		
IS : 1230	Cast iron rain water pipes and fittings.		
IS : 1239	Mild steel tubes, tubulars and other wrought steel fittings.		
IS : 1536	Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.		
IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.		
IS : 1538	Cast iron fittings for pressure pipe for water, gas and sewage.		
IS : 1703	Ball valves (horizontal plunger type) including float for water supply purposes.		
IS : 1726	Cast iron manhole covers and frames.		
IS : 1729	Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.		
IS : 1742	Code of practice for building drainage.		
IS : 1795	Pillar taps for water supply purposes.		
IS : 1879	Malleable cast iron pipe fittings.		
IS : 2064	Code of practice for selection, installation and maintenance of sanitary appliances.		
IS : 2065	Code of practice for water supply in building.		
IS : 2326	Automatic flushing cisterns for urinals.		
IS : 2470 (Part-I & II)	Code of practice for installation of septic tanks.		
IS : 2501	Copper tubes for general engineering purposes.		
IS : 2548	Plastic seat and cover for water-closets.		
IS : 2556 (Part 1 to 15)	Vitreous sanitary appliances (vitreous china).		
IS : 2963	Non-ferrous waste fittings for wash basins and sinks.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS : 3114	Code of practice for laying of cast iron pipes.		
IS : 3311	Waste plug and its accessories for sinks and wash basins.		
IS : 3438	Silvered glass mirrors for general purposes.		
IS : 3486	Cast iron spigot and socket drain pipes.		
IS : 3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).		
IS : 3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.		
IS : 4111 (Part I to IV)	Code of practice for ancillary structure in sewerage system.		
IS : 4127	Code of practice for laying of glazed stone-ware pipes.		
IS : 4764	Tolerance limits for sewage effluents discharged into inland-surface waters.		
IS : 4827	Electro plated coating of nickel and chromium on copper and copper alloys.		
IS : 5329	Code of practice for sanitary pipe work above ground for buildings.		
IS : 5382	Rubber sealing rings for gas mains, water mains and sewers.		
IS : 5822	Code of practice for laying of welded steel pipes for water supply.		
IS : 5961	Cast iron grating for drainage purpose.		
IS : 7740	Code of practice for road gullies.		
IS : 8931	Cast copper alloy fancy bib taps and stop valves for water services.		
IS : 8934	Cast copper alloy fancy pillar taps for water services.		
IS : 9762	Polyethylene floats for ball valves.		
IS : 10446	Glossary of terms for water supply and sanitation.		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 62 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS : 10592</p> <p>IS : 12592</p> <p>IS : 12701</p> <p>SP: 35</p> <p>-</p> <p>Doors, Windows and Allied Works</p> <p>IS : 204</p> <p>Part-I</p> <p>Part-II</p> <p>IS : 208</p> <p>IS : 281</p> <p>IS : 362</p> <p>IS : 420</p> <p>IS : 1003 Part-I door</p> <p>IS : 1038</p> <p>IS : 1081</p> <p>IS : 1341</p> <p>IS : 1361</p> <p>IS : 1823</p> <p>IS : 1868</p> <p>IS : 2202 (Part-II)</p>	<p>Industrial emergency showers, eye and face fountains and combination units.</p> <p>Specification for precast concrete manhole covers and frames.</p> <p>Rotational moulded polyethylene water storage tanks.</p> <p>Hand book on water supply and drainage.</p> <p>Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.</p> <p>Tower Bolts</p> <p>Ferrous metals.</p> <p>Nonferrous metals.</p> <p>Door Handles.</p> <p>Mild steel sliding door bolts for use with padlocks.</p> <p>Parliament Hinges.</p> <p>Specification for putty, for use on metal frames.</p> <p>Specification for timber panelled and glazed shutters- (Part-I) shutters.</p> <p>Steel doors, windows and ventilators.</p> <p>Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.</p> <p>Steel butt hinges.</p> <p>Steel windows for industrial buildings.</p> <p>Floor door stoppers.</p> <p>Anodic coatings on Aluminium and its alloys.</p> <p>Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels</p>	
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 63 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS:2209	Mortice locks (vertical type).		
IS:2553	Safety glass		
IS:2835	Flat transparent sheet glass.		
IS:3548	Code of practice for glazing in buildings.		
IS:3564	Door closers (Hydraulically regulated).		
IS : 3614	Fire check doors; plate, metal covered and rolling type.		
IS:4351	Steel door frames.		
IS:5187	Flush bolts.		
IS:5437	Wired and figured glass		
IS:6248	Metal rolling shutters and rolling grills.		
IS:6315	Floor springs (hydraulically regulated) for heavy doors.		
IS:7196	Hold fasts.		
IS:7452	Hot rolled steel sections for doors, windows and ventilators.		
IS:10019	Mild steel stays and fasteners.		
IS:10451	Steel sliding shutters (top hung type).		
IS:10521	Collapsible gates.		
R oof Water Proofing and AlliedWorks			
IS:1203	Methods of testing tar and bitumen.		
IS:1322	Specification for bitumen felts for water proofing and damp proofing.		
IS:1346	Code of practice for water proofing of roofs with bitumen felts.		
IS:1580	Specification for bituminous compound for water proofing and caulking purposes.		
<p align="center">LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 64 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.		
IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.		
Floor Finishes and Allied Works			
IS:1237	Specification for cement concrete flooring tiles.		
IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.		
IS:2114	Code of practice for laying in-situ terrazzo floor finish.		
IS:2571	Code of practice for laying in-situ cement concrete flooring.		
IS:3462	Specification for unbacked flexible PVC flooring.		
IS:4971	Recommendations for selection of industrial floor finishes.		
IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.		
IS:8042	Specification for white portland cement.		
IS:13801	Specification for chequered cement concrete flooring tiles.		
Painting and Allied Works			
IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.		
IS:1477	Code of practice for painting of ferrous metals in buildings.		
Part-I	Pretreatment.		
Part-II	Painting.		
IS:1650	Specification for colours for building and decorative finishes.		
IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.		
IS:2338	Code of practice for finishing of wood and wood based materials.		
Part-I	Operations and workmanship		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 65 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	Part-II	Schedules	
	IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.	
	Part-I	Operations and workmanship.	
	Part-II	Schedule.	
	IS:2524	Code of practice for painting of nonferrous metals in buildings.	
	Part-I	Pretreatment.	
	Part-II	Painting.	
	IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.	
	IS:2933	Specification enamel paint, under coating and finishing.	
	IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.	
	IS:5410	Specification for cement paint	
	IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use	
	IS:6278	Code of practices for white washing and colour washing.	
	IS:10403	Glossary of terms relating to building finishes.	
	Piling and Foundation		
	IS:1080	Code of practice for design and construction of simple spread foundations.	
	IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.	
	IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).	
	IS:2950	Code of practice for designs and construction of Raft (Part-I) foundation.	
	IS:2974 (Part-I TO V)	Code of practice for design and construction of machine foundations.	
	IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.	
<p align="center">LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 66 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS:8009		Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.	
Part-I		Shallow foundations.	
Part-II		Deep foundations.	
IS:12070		Code of practice for design and construction of shallow foundations on rocks.	
DIN:4024		Flexible supporting structures for machines with rotating machines.	
VDI:2056		Criteria for assessing mechanical vibrations of machines.	
VDI:2060		Criteria for assessing rotating imbalances in machines.	
Stop Log and Trash Rack			
IS:4622		Recommendations for fixed - wheel gates structural design.	
IS:5620		Recommendations for structural design criteria for low head slide gates.	
IS:11388		Recommendations for design of trash rack for intakes.	
IS:11855		General requirements for rubber seals for hydraulic gates.	
Roads			
IRC:5		Standard specifications and Code of practice for road bridges, section-I general Features of Design.	
IRC:14		Recommended practice of 2cm thick bitumen and tar carpets.	
IRC:16		Specification for priming of base course with bituminous primers.	
IRC:19		Standard specifications and code of practice for water bound macadam.	
IRC:21		Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).	
IRC:34		Recommendations for road construction in waterlogged areas.	
IRC:36		Recommended practice for the construction of earth embankments for road works.	
IRC:37		Guidelines for the Design of flexible pavements.	
IRC:56		Recommended practice for treatment of embankment slopes for erosion control.	
IRC:73		Geometric design standards for rural (non-urban) highways.	
IRC:86		Geometric Design standards for urban roads in plains.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IRC:SP:13</p> <p>IRC - Public- ation</p> <p>IS:73</p> <p>Loadings</p> <p>IS:875 (Pt. I to V)</p> <p>IS:1893</p> <p>IS:4091</p> <p>IRC:6</p> <p>M.O.T.</p> <p>Safety</p> <p>IS:3696 (Part I & II)</p> <p>IS:3764</p> <p>IS:4081</p> <p>IS:4130</p> <p>IS:5121</p> <p>IS:5916</p> <p>IS:7205</p> <p>IS:7293</p> <p>IS:7969</p> <p>IS:11769</p> <p>- Indian Explosives Act. 1940 as updated.</p> <p>Architectural design of buildings</p> <p>SP:7</p> <p>SP:41</p>	<p>Guidelines for the design of small bridges & culverts.</p> <p>Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.</p> <p>Specification for paving bitumen</p> <p>Code of practice for design loads other than earthquake) for buildings and structures.</p> <p>Criteria for earthquake resistant design of structures.</p> <p>Code of Practice for design and construction of foundation for transmission line towers & poles.</p> <p>Standard specifications & code of practice for road bridges, Section-II Loads and stresses.</p> <p>Deptt. of railways Bridge Rules.</p> <p>Safety code for scaffolds and ladders.</p> <p>Safety code for excavation work.</p> <p>Safety code for blasting and related drilling operations.</p> <p>Safety code for demolition of buildings.</p> <p>Safety code for piling and other deep foundations.</p> <p>Safety code for construction involving use of hot bituminous materials.</p> <p>Safety code for erection on structural steelwork.</p> <p>Safety code for working with construction machinery.</p> <p>Safety code for handling and storage of building materials</p> <p>Guidelines for safe use of products containing asbestos.</p>	
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 68 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Miscellaneous</p> <p>IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers.</p> <p>IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.</p> <p>IS:10430 Creteria for design of lined canals and liner for selection of type of lining.</p> <p>IS:11592 Code of practice for selection and design of belt conveyors.</p> <p>IS:12867 PVC handrails covers.</p> <p>CIRIA Design and construction of buried thin-wall pipes.</p> <p>Publication</p> <p>REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION</p> <p>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 equivalentents.</p> <p>Temperature Measurements</p> <ol style="list-style-type: none"> 1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). 2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. 3. Temperature measurement by electrical Resistance thermometers - IS:2806. 4. Thermometer - element - Platinum resistance - IS:2848. <p>Pressure Measurements</p> <ol style="list-style-type: none"> 1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). <li style="padding-left: 20px;">b) Electonic transmitters BS:6447. 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. 3. Process operated switch devices (Pr. Switch) BS-6134. 			
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 69 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Flow Measurements</p> <p>Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II.</p> <p>Measurement of fluid flow in closed conduits - BS-1042.</p> <p>Electronic Measuring Instrument & Control Hardware/ Software</p> <ol style="list-style-type: none"> 1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. 2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. 3. Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. 4. Dynamic response testing of process control instrumentation ISA - S 26 (1968). 5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. 6. Printed circuit boards - IPC TM - 650, IEC 326 C. 7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. 8. Edge socket connectors - IEC 130-11. 9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. 10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). 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. 			
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 70 OF 83</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985.</p> <p>17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985.</p> <p>18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984.</p> <p>19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983.</p> <p>20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978.</p> <p>21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987.</p> <p>22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.</p> <p>Instrument Switches and Contact</p> <p>1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000.</p> <p>2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600.</p> <p>Enclosures</p> <p>1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13).</p> <p>2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972).</p> <p>3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962.</p> <p>Apparatus, enclosures and installation practices in hazardous area</p> <p>1. Classification of hazardous area - NFPA 70 - 1984, Article 500.</p> <p>2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973.</p> <p>3. Intrinsically safe apparatus - NFPA 493 1978.</p> <p>4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982.</p> <p>5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.</p>			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>Sampling System</p> <ol style="list-style-type: none"> 1. Stainless steel material of tubing and valves for sampling system - ASTM A 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. <p>Annunciators</p> <ol style="list-style-type: none"> 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 3. Damp heat cycling test - IS:2106 4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78 <p>Protections</p> <ol style="list-style-type: none"> 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA 85 - 2011 or latest version. <p>UPS System</p> <ol style="list-style-type: none"> 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991. 	
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p> <p>PAGE 72 OF 83</p>

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985.</p> <p>7. Printed Circuit Board - IPC TM 650, IEC 326C.</p> <p>8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973.</p> <p>Control Valves</p> <p>1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985.</p> <p>2. Face to face dimensions of control valves - ANSI B 16.00 - 1973.</p> <p>3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2).</p> <p>4. Codes for pressure piping - ANSI B 31.1</p> <p>5. Control Valve leak class - ISA RP 39.6</p> <p>Process Connection & Piping</p> <p>1. Codes for pressure piping "power piping" - ANSI B 31.1.</p> <p>2. Seamless carbon steel pipe ASTM - A - 106.</p> <p>3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182.</p> <p>4. Material for socket welded fittings - ASTM - A - 105.</p> <p>5. Seamless ferritic alloy steep pipe - ASTM - A - 335.</p> <p>6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234.</p> <p>7. Composition bronze of ounce metal castings - ASTM - B - 62.</p> <p>8. Seamless Copper tube, bright annealed - ASTM - B - 168.</p> <p>9. Seamless copper tube - ASTM - B - 75.</p> <p>10. Dimension of fittings - ANSI - B - 16.11.</p> <p>11. Valves flanged and butt welding ends - ANSI - B - 16.34.</p> <p>Instrument Tubing</p> <p>1. Seamless carbon steel pipe - ASTM - A 106.</p> <p>2. Material of socketweld fittings - ASTM - A105.</p> <p>3. Dimensions of fittings - ANSI - B - 16.11.</p>	
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p> <p>PAGE 73 OF 83</p>

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1.</p> <p>Cables</p> <p>1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992.</p> <p>2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815.</p> <p>3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions through 2/83.</p> <p>4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6).</p> <p>5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977.</p> <p>6. Rules for Testing insulated cables and flexible cables : VVDE - 0472</p> <p>7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)</p> <p>8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81.</p> <p>9. Oxygen index and temperature index test - ASTM D - 2863.</p> <p>10. Smoke density measurement test - ASTM D - 2843.</p> <p>11. Acid gas generation test - IEC - 754 - 1.</p> <p>12. Swedish Chimney test - SEN - 4241475 (F3).</p> <p>13. Teflon (FEP) insulation & sheath test - ASTM D - 2116.</p> <p>14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784.</p> <p>15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I).</p> <p>Cable Trays, Conduits</p> <p>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.</p> <p>2. -do- Test Standards. NEMA VE-1-1979.</p> <p>3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTM A - 386-78.</p>			
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 74 OF 83</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Public Address System</p> <ol style="list-style-type: none"> 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 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. <p>Vibration Monitoring System</p> <ol style="list-style-type: none"> 1. API 670 - 1994 2. BS : 4675 Part-2 			
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO. CS-0011-109(1A)-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 75 OF 83</p>	

ANNEXURE-I

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


SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	**	10.	11.	
<p>LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS 'W'</p>													
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE		FOR NTPC USE		DOC. NO.: REV CAT		REVIEWED BY APPROVED BY		APPROVAL SEAL	
FORMAT NO.: QS-01-QAI-P-09/F1-R1 1/1 ENGG. DIV./QA&I													

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ANNEXURE-II

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


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

		DOC. NO.:	REV.
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	REVIEWED BY	APPROVED BY
SIGNATURE	1/1		APPROVAL SEAL
FORMAT NO.: QS-01-QAI-P-09/F2-R1			
ENG. DIV./QA&I			

LEGEND: * RECORDS IDENTIFIED WITH 'TICK' (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-C BID DOC.NO.:CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENT
LOT-1A PROJECTS		PAGE 77 OF 83


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 on 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.


FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE LOT-IA PROJECTS	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENT PAGE 78 OF 83
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ANNEXURE-IV


		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 comm t Appl.	Status Code C/III	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks							
FORMAT												1/1		Engg. Div. / QA&I				


LOT-1A PROJECTS STEAM GENERATOR ISLAND PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-C BID DOC.NO.:CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENT	PAGE 79 OF 83
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ANNEXURE-V

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

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-C BID DOC.NO.:CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENT	PAGE 80 OF 83
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	
	First submission and submission with major changes			
	▪ Layout (A0&A1 sizes)	4	-	
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-	
	▪ P&ID (All sizes)	4	-	
	a) Final drawings/documents (Directly to site)	6	2	
	b) "As Built" Drawing/Documents (Directly to site)	6	2	
	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2	
2	Erection Manual (Directly to site)	4 sets	2	
3	Operation & Maintenance manual i) First Submission	1 set	--	
	ii) Final Submission (Directly to site)	4 sets	2	
4	Plant Hand Book i) First Submission	1	1	
	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--	
	ii) Final Submission (Directly to site)	4 sets	2	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 81 OF 83	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
	S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets		-
	ii) Approved Copies (Direct to Site)	4 sets		2
7	Project Completion Report (Directly to site)	6 sets		2
8	QA programme including Organisation for implementation and QA system manual(with revisions)	1		-
9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2		-
10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1		-
	ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4		2
11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set		-
	ii) Approved copies (Direct to Site)	4 sets		2
12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets		2
13	QA Documentation Package for field activities on equipment/systems at site	2 sets		2
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS-0011-109(1A)-2	GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 82 OF 83	


GENERAL TECHNICAL REQUIREMENTS


ANNEXURE-VII

CLAUSE NO.		AREAS OF TRAINING REQUIREMENT			
PRODUCT	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant	
FGD	<p>Layout & model of FGD area, cable & piping trestles etc.</p> <p>FGD</p> <ul style="list-style-type: none"> • Mass balance, Design, selection and sizing calculations of FGD system, • Training on factors affecting sizing/ efficiency of FGD system, equipments & auxiliaries • Materials for FGD & selection • Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc.. • FGD electrical system • FGD control system <p>Erection strategies, erection procedures</p> <p>Performance as per applicable code and demonstration tests.</p>	<p>Familiarization with various system and equipment</p> <p>Performance, data collection analysis and review</p> <p>O&M feed back</p> <p>Operation history of various equipments and system</p> <p>Failure analysis</p>	<p>Manufacturing process of Absorber and equipments</p> <p>Welding process</p> <p>Testing facilities</p> <p>Product development in process</p> <p>Future plan for technology induction</p> <p>R&D work in progress</p>	<p>Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues.</p> <p>Familiarization of special maintenance techniques</p> <p>Special tool and tackles familiarization</p>	
MAN/MONTH	2	0.5	0.5	6	
ZLD System (In Projects where ZLD System is provided by Contractor)	<ul style="list-style-type: none"> • Basic design features of ZLD system for FGD WWTP Plant • Theory & principle of operation • Discussions on various measurement points, Types, Ranges and locations for the offered system • Latest technological trends in ZLD system for FGD WWTP Plant and design aspects • Software and model test 	<p>Operational feedback O&M history/ problems related to ZLD system</p>	<p>Training on ZLD system for FGD Waste water</p> <p>System description, basic design and engineering</p> <p>Manufacturing process of ZLD system equipments</p> <p>Testing facilities</p>	<p>Trouble shooting and fault analysis</p> <p>Familiarization of special maintenance techniques</p> <p>Special tool and tackles familiarization</p>	
MAN/MONTH	0.5	0.25	0.25	1	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
	<p>(xiii) Air Conditioning System</p> <p>A. Following shall be demonstrated at Shop</p> <p>1) Capacity and static pressure of AHU fans at its rated duty point.</p> <p>B. Following shall be demonstrated at Site</p> <p>1) Capacity (TR) of air cooled condensing units (D-X type) for A/C system of FGD control room building.</p> <p>2) Guaranteed room conditions during summer for all the Air conditioned areas.</p> <p>3) Vibration and noise level of condensing units & centrifugal fans of AHUs.</p> <p>(xiv) Ventilation System</p> <p>A. Following shall be demonstrated at Shop</p> <p>1) Capacity and discharge pressure of pumps of UAF units at its rated duty point of Ventilation system.</p> <p>2) Capacity and static pressure of UAF fans at its rated duty point of Ventilation system.</p>			
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 19 OF 24</p>	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
5.00.00	<p>AUXILIARY POWER CONSUMPTION (PA)</p> <p>The unit auxiliary power consumption shall be calculated using the following relationship.</p> $P_a = (P_{a1} + P_{a2} + \dots + P_{an}) / n$ $P_{an} = P_{un} + T_{Ln}$ <p>P_a = Guaranteed Auxiliary Power Consumption.</p> <p>P_{an} = Auxiliary Power Consumption for unit # 1,2, --n.</p> <p>(Where "n" is the total no. of unit in project)</p> <p>P_{un} = Power consumed by the auxiliaries of the unit under test</p> <p>T_{Ln} = Losses of the transformers supplied by bidder based on works test reports.</p> <p>While guaranteeing the auxiliary power consumption the bidder shall necessarily include all continuously operating auxiliaries under this package. The auxiliaries to be considered shall include but not be limited to the following:</p>			
<p align="center">FGD LOT-I PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2</p>	<p align="center">SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p align="center">PAGE 1 OF 3</p>	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
	<p>xxi. Air Conditioning System (*)</p> <p>Total 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 FGD Control Room Building divided by the number of units in the project.</p> <p>xxii. Total Power consumption at motor input terminal of fan of UAF (*) divided by the number of units in the project.</p> <p>((*) Above guaranteed power consumption values shall be at 20 deg C for centrifugal fans of AHUs and at 30 deg C for centrifugal fans of UAF and at an elevation of RL of site for both AHUs and UAF centrifugal fans.)</p>			
<p align="center">FGD LOT-I PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2</p>	<p align="center">SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p align="center">PAGE 2 OF 3</p>	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
	<p>The equipments listed above for calculating auxiliary power consumption are indicative. Any other equipment required for continuous operation of the system shall also be considered for calculation of auxiliary power consumption. Power consumption of all equipments provided on unitized basis shall be included in the unit auxiliary power consumption. For common station auxiliaries, the power consumption shall be assigned to each unit based on unit load for the purpose of calculating the unit auxiliary power consumption.</p> <p>Note :</p> <ol style="list-style-type: none"> 1. The bidder shall furnish a list of equipments to be covered under auxiliary power consumption, which shall be subject to Employer's approval. 2. The equipments listed above for calculating auxiliary power consumption are indicative. Any other equipment required for continuous operation of the system shall also be considered for calculation of auxiliary power consumption. 3. Transformer losses (TL) shall be considered as per following (as applicable) – Aux/LT Outdoor/ LT Indoor Transformer: 100 % No load loss and 25 % of Copper Losses. 4. Auxiliary power shall be measured without SCR (De-NOx) system. 5. Auxiliary power shall be measured at the switchgear of the drives. 			
<p align="center">FGD LOT-I PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2</p>	<p align="center">SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p align="center">PAGE 3 OF 3</p>	





SUB-SECTION-V-QM4


AIR CONDITIONING & VENTILATION SYSTEM


**LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2**

CLAUSE NO.	QUALITY ASSURANCE		
AIR CONDITIONING AND VENTILATION SYSTEM FOR FGDS			
CLAUSE NO	QA MODULE FOR AIR CONDITIONING AND VENTILATION SYSTEM		
1.00.00	Air cooled Condensing Unit (Outdoor unit), Evaporating unit (Indoor unit)		
1.01.00	Compressor of Condensing Unit shall be tested as per relevant standard		
1.01.01	Condenser (Heat Exchanger) , Evaporator coils assembly shall be subjected to Hydraulic/Pneumatic pressure/leakage test as applicable and Electronic refrigerant leakage test along with all relevant test on tube as per applicable code..		
1.01.02	Assembled Condensing unit (Outdoor Unit) shall be subjected to Leakage test,Vacuum test, Run test/Functional test as applicable		
2.00.00	FANS		
2.01.00	20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.		
2.02.00	DPT of fan shafts shall be carried out after machining.		
2.03.00	UT of fan shafts (diameter equal to or above 50mm) shall be carried out.		
2.04.00	Rotating components of all fans shall be dynamically balanced to ISO-1940 Gr. 6.3		
2.05.00	All Fans shall be subjected to run test for 4 hrs. or till temperature stabilization is reached. Vibration, Noise level, Temp. rise and current drawn shall be measured during the run test.		
2.06.00	One fan of each type and size will be performance tested as per corresponding BIS /AMCA for Air flow, Static Pressure, Speed, Efficiency, Power Consumption, Noise, Vibration and Temp. Rise.		
3.00.00	AIR HANDLING UNIT		
3.01.00	For Fans refer tests as mentioned at 2.00.00		
3.02.00	One per type of assembled AHU (AHU casing and fan assembly) shall be subjected to free run test. Noise, Vibration and Temp. Rise of bearing shall be measured during run test.		
3.03.00	All cooling coil shall be pneumatically tested and no leakage shall be permitted.		
4.00.00	CENTRIFUGAL PUMP		
4.01.00	UT on pump shaft (dia equal to or above 40 mm) and MPI/DPT on pump shaft and impeller after machining shall be carried out.		
4.02.00	All rotating components of the pumps shall be dynamically balanced to ISO-1940 Gr. 6.3		
4.03.00	A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the shut off pressure on the head characteristics curve or twice the rated pressure whichever is higher, for a minimum duration of 30 minutes.		
4.04.00	Standard Running Test		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-0011-109(1A)-2	SUB-SECTION -V- QM4 AIR CONDITIONING & VENTILATION SYSTEM	Page 1 of 3


CLAUSE NO.	QUALITY ASSURANCE		
4.05.01	All pumps shall be tested in the manufacturer's works preferably with contract motor for capacity, efficiency, head and brake horse power. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. The duration of test shall be minimum one (1) hr. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standard (HIS) and/or as per applicable Indian Standard or equivalent. Acceptance norms shall be as per approved datasheet & HIS standard only.		
4.05.02	Noise and vibration shall be measured at shop for reference purpose only.		
4.05.03	Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.		
4.05.04	NPSH test shall be conducted with water as the medium, if required as per approved data sheets.		
5.00.00	LOW PRESSURE AIR DISTRIBUTION SYSTEM		
5.01.00	Functional test for fire damper along with solenoid shall be done.		
5.02.00	Prototype tests report of fire damper (duly approved/accepted by ENGG) for each type and size as per UL-555 for fire rating shall be furnished.		
5.03.00	Site Test- After completion, all ducting system shall be checked/tested for air leakages/tightness (smoke test) at site.		
6.00.00	INSULATION		
6.01.00	Insulation material shall be tested for all mandatory tests only as per relevant code/standard.		
6.02.00	Thermal conductivity tests (for thermal insulation only) shall be done as per relevant code for the same density and thickness of material and validity of test shall be as per relevant standard.		
7.00.00	AIR FILTERS		
7.01.00	Pre/Fine filters shall be tested for initial and final pressure drop Vs flow and average synthetic dust weight arrestance as per the requirement of BS 6540/ASHARE-52-76/EN779. HEPA (Absolute) filters shall be tested as per applicable code.		
8.00.00	PIPES & FITTINGS		
8.01.00	All pipes and fittings shall be tested as per applicable codes / standard.		
8.02.00	Site test- Pipes shall be tested at site hydraulically/pneumatically as per application requirement		
9.00.00	VALVES & SPECIALTIES		
9.01.00	Visual and dimensional check of valves as per relevant codes and approved drawing.		
9.02.00	All the water line valves shall be hydraulically tested for body, seat and back seat (wherever provided) as per the relevant standard to which these valves are supplied irrespective of the working pressure for which these valves are selected. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.		
<p align="center">LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-0011-109(1A)-2</p>	<p align="center">SUB-SECTION -V- QM4 AIR CONDITIONING & VENTILATION SYSTEM</p>	<p align="center">Page 2 of 3</p>

CLAUSE NO.	QUALITY ASSURANCE			
9.03.00	Valves shall be offered for hydro test and pneumatic test in unpainted condition.			
9.04.00	Functional check of the valves for smooth opening and closing shall be done.			
10.00.00	SPLIT/CASSETTE / WINDOW AC/ PAC			
10.01.00	Split/Cassette/ Window AC will be accepted on the basis of Manufacturer Standard Guarantee and Warrantee certificate.			
10.02.00	PAC Each Unit shall be subjected to production routine Test excluding performance test carried out as per relevant standard.			
10.03.00	Performance test of PAC shall be carried out as per relevant standard on one unit of each type and rating at site.			
11.00.00	Unitary Air Filter (UAF)			
11.01.00	Random 10% DPT on weld joints shall be carried out			
11.02.00	Hydraulic test of pressure parts at 1.5 times the design. Pressure and water fill test of tanks shall be carried out			
11.03.00	Trial assembly of Air washer/UAF for one of each size shall be done in shop.			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-0011-109(1A)-2	SUB-SECTION -V- QM4 AIR CONDITIONING & VENTILATION SYSTEM	Page 3 of 3

	3X660 MW NABINAGAR TPP (FGD System Package) HVAC SYSTEM PAINTING SPECIFICATIONS	SPECIFICATION No: PE-TS-457-(571-13000-A)-A001	
		SECTION : I	
		SUB-SECTION : C 2C	
		REV. 00	

SECTION: I
SUB-SECTION: C 2C
(PAINTING SPECIFICATION)

REFER SECTION C2-A

	<p align="center">3X660 MW NABINAGAR TPP (FGD System Package) HVAC SYSTEM TECHNICAL SPECIFICATION (ELECTRICAL PORTION)</p>	SPECIFICATION No: PE-TS-457-(571-13000-A)-A001	
		SECTION : I	
		SUB-SECTION : C-3	
		REV. 00	

SECTION: I

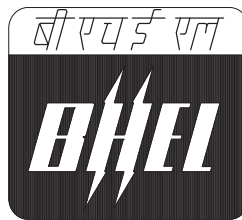
SUB-SECTION: C-3

TECHNICAL SPECIFICATION (ELECTRICAL PORTION)

3X660 MW NABINAGAR-I FGD

TECHNICAL SPECIFICATION

AC & VENTILATION SYSTEM
(ELECTRICAL PORTION)



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP [INDIA]

34631/2020/PS-PEM-MAX



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AC & VENTILATION SYSTEM
3X660 MW NABINAGAR-I FGD**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **I**REV NO. : **00** DATE: 21.01.2020

SHEET: 1 OF 1

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SECTION	TITLE	NO OF SHEETS
I	SPECIFIC TECHNICAL REQUIREMENTS	3
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I	CABLE SCHEDULE FORMAT (ANNEXURE-III)	1
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I	MOTOR DATASHEET-A	1
I	MOTOR DATASHEET-C	2
II	STANDARD SPECIFICATION FOR LV MOTORS	5
II	REFERENCE QUALITY PLAN	3
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II	TECHNICAL SPECIFICATION FOR CABLE TRAYS & ACCESSORIES	7
II	TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES	2

The requirements mentioned in Section-I shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-II.

34631/2020/PS-PEM-MAX



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AC & VENTILATION SYSTEM
3X660 MW NABINAGAR-I FGD**

SPECIFICATION NO.
VOLUME NO. : **II-B**
SECTION : **I**
REV NO. : **00** DATE : 21.01.2020
SHEET : 1 OF 3

**TECHNICAL SPECIFICATION
FOR
AC & VENTILATION SYSTEM
(ELECTRICAL PORTION)**



TITLE :	SPECIFICATION NO.
ELECTRICAL EQUIPMENT SPECIFICATION	
FOR	VOLUME NO. : II-B
AC & VENTILATION SYSTEM	SECTION : I
3X660 MW NABINAGAR-I FGD	REV NO. : 00 DATE : 21.01.2020
	SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for AC & VENTILATION SYSTEM (all AC & DC loads at different voltage levels like 415V AC, 240 V AC, 220 V DC etc).
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 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.

34631/2020/PS-PEM-MAX



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
 FOR
 AC & VENTILATION SYSTEM
 3X660 MW NABINAGAR-I FGD**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **I**REV NO. : **00** DATE : 21.01.2020

SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)

REV-0, DATE: 09.03.2015

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : AC & VENTILATION SYSTEM

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

PROJECT: 3X660 MW NABINAGAR-I FGD

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
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.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	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.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.

REV-0, DATE: 09.03.2015

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : AC & VENTILATION SYSTEM

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

PROJECT: 3X660 MW NABINAGAR-I FGD

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	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	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. 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.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

ANNEXURE-3

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/INT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA LOAD RKS No.	VERIFICATION FROM MOTOR DATASHEET (Y/N)	KKS NO			
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOS								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.	436		
	PROJECT TITLE	3X660 MW NABINAGAR-I FGD	NAME	PEM (ELECTRICAL)
	SYSTEM	AC & VENTILATION SYSTEM	SIGN.	DATA FILLED UP ON
	DEPTT. / SECTION	MAX	SHEET 1 OF 1	DE'S SIGN. & DATE
			REV. 00	

ANNEXURE III

CABLE SCHEDULE FORMAT

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V

(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
 C = 3.3KV (Power cables)
 D = 1.1KV (LV & DC system power & control cables)
 E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS
 C = unarmoured FRLS
 B = Armoured Non-FRLS
 D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS
 G = unarmoured FRLS
 F = Armoured Non-FRLS
 H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS
 L = unarmoured FRLS
 K = Armoured Non-FRLS
 M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS
 Q = unarmoured FRLS
 P = Armoured Non-FRLS
 R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
 T = TOUGH RUBBER SHEATH
 U = OVERALL SCREENED
 V = PAIRED OVERALL SCREENED
 W = PAIRED INDIVIDUAL SCREENED
 Y = COMPENSATING CABLES
 I = PRE-FABRICATED CABLES
 Z = JELLY FILLED CABLES



SUB-SECTION-II-E2


MOTORS


**LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**


**TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2**


CLAUSE No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																																				
	<p style="text-align: center;">MOTORS</p> <p>1.00.00 GENERAL REQUIREMENTS</p> <p>1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.</p> <p>1.02.00 All equipment's shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.</p> <p>1.03.00 Contactor shall provide fully compatible electrical system, equipment's, accessories and services.</p> <p>1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.</p> <p>1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.</p> <p>1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.</p> <p>1.07.00 Degree of Protection</p> <p>Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 5%;">i)</td> <td style="width: 45%;">Indoor motors</td> <td style="width: 10%;">-</td> <td style="width: 40%;">IP 54</td> </tr> <tr> <td>ii)</td> <td>Outdoor motors</td> <td>-</td> <td>IP 55</td> </tr> <tr> <td>iii)</td> <td>Cable box-indoor area</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>iv)</td> <td>Cable box-Outdoor area</td> <td>-</td> <td>IP 55</td> </tr> </table> <p>2.00.00 CODES AND STANDARDS</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 5%;">1)</td> <td style="width: 45%;">Three phase induction motors</td> <td style="width: 10%;">:</td> <td style="width: 40%;">IS/IEC:60034</td> </tr> <tr> <td>2)</td> <td>Single phase AC motors</td> <td>:</td> <td>IS/ IEC:60034</td> </tr> <tr> <td>3)</td> <td>Crane duty motors</td> <td>:</td> <td>IS:3177, IS/IEC:60034</td> </tr> <tr> <td>4)</td> <td>DC motors/generators</td> <td>:</td> <td>IS:4722, IS/IEC:60034</td> </tr> <tr> <td>5)</td> <td>Energy Efficient motors</td> <td>:</td> <td>IS 12615, IEC:60034-30</td> </tr> </table>	i)	Indoor motors	-	IP 54	ii)	Outdoor motors	-	IP 55	iii)	Cable box-indoor area	-	IP 54	iv)	Cable box-Outdoor area	-	IP 55	1)	Three phase induction motors	:	IS/IEC:60034	2)	Single phase AC motors	:	IS/ IEC:60034	3)	Crane duty motors	:	IS:3177, IS/IEC:60034	4)	DC motors/generators	:	IS:4722, IS/IEC:60034	5)	Energy Efficient motors	:	IS 12615, IEC:60034-30	
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<p style="text-align: center;">LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 204 of 525</p>	<p style="text-align: center;">SUB SECTION-II-E2 MOTORS</p>	<p style="text-align: center;">PAGE 1 OF 9</p>																																			


CLAUSE No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
3.00.00	TYPE		
3.01.00	AC Motors:		
	a) Squirrel cage induction motor suitable for direct-on-line starting.		
	b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3 , conforming to IS 12615, or IEC:60034-30.		
	c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.		
	d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.		
3.02.00	DC Motors Shunt wound.		
4.00.00	RATING		
	(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.		
	(b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.		
5.00.00	TEMPERATURE RISE		
	Air cooled motors		
	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.		
	Water cooled		
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.		
6.00.00	OPERATIONAL REQUIREMENTS		
6.01.00	Starting Time		
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.		
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.		
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 205 of 525	SUB SECTION-II-E2 MOTORS	PAGE 2 OF 9


CLAUSE No.	TECHNICAL REQUIREMENTS		
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.		
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.		
6.02.00	Torque Requirements		
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.		
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.		
6.03.00	Starting voltage requirement (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 (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW		
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES		
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.		
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)		
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 206 of 525	SUB SECTION-II-E2 MOTORS	PAGE 3 OF 9

CLAUSE No.	TECHNICAL REQUIREMENTS		
7.03.00	<p>Winding and Insulation</p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature.</p> <p>(c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15.</p> <p>(d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better</p>		
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.		
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.		
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.		
7.08.00	Motor body shall have two earthing points on opposite sides.		
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.		
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Employer shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.		
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 207 of 525</p>	<p>SUB SECTION-II-E2 MOTORS</p>	<p>PAGE 4 OF 9</p>

CLAUSE No.	TECHNICAL REQUIREMENTS		
7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.		
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.		
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.		
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.		
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.		
8.00.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance):</p> <p>(a) From 50KW & upto 110KW : 11.0</p> <p>(b) From 110 KW & upto 200 KW : 9.0</p> <p>(c) Above 200 KW & upto 1000KW : 10.0</p> <p>(d) From 1001KW & upto 4000KW : 9.0</p> <p>(e) Above 4000KW : 6 to 6.5</p>		
10.00.00	TYPE TEST		
10.01.00	HT MOTORS		
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.		
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.		
10.01.03	In case the Contactor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering		
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 208 of 525	SUB SECTION-II-E2 MOTORS	PAGE 5 OF 9

CLAUSE No.	TECHNICAL REQUIREMENTS		
	<p>the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor.</p>		
10.01.04	<p>Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>		
10.01.05	<p>LIST OF TYPE TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <ul style="list-style-type: none"> (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose. 		
10.01.06	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <ul style="list-style-type: none"> (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. 		
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 209 of 525</p>	<p>SUB SECTION-II-E2 MOTORS</p>	<p>PAGE 6 OF 9</p>

CLAUSE No.	TECHNICAL REQUIREMENTS		
	<p>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</p> <p>(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15</p> <p>(d) Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15</p>		
10.02.00	LT Motors		
10.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>		
10.02.02	<p>However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>		
10.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p> <ol style="list-style-type: none"> 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 per clause no 7.06.00 of this section) 		
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 210 of 525</p>	<p>SUB SECTION-II-E2 MOTORS</p>	<p>PAGE 7 OF 9</p>

CLAUSE No.	TECHNICAL REQUIREMENTS			
<p>10.03.00</p> <p>10.04.00</p>	<p>10. Test for degree of protection and</p> <p>11. Overspeed test.</p> <p>12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1</p> <p>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.</p> <p>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.</p>			
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 211 of 525</p>	<p>SUB SECTION-II-E2 MOTORS</p>	<p>PAGE 8 OF 9</p>	

TECHNICAL REQUIREMENTS



TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW of	Minimum distance between centre of stud and gland plate in mm As per manufacturer's practice.
UP to 3 KW	
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

34631/2020/PS-PEM-MAX^{TITLE}**LV MOTORS****DATA SHEET-A**

3X660 MW NABINAGAR-I FGD

SPECIFICATION NO.

VOLUME II B

SECTION D

REV. NO. DATE:21.01.2020

SHEET 1 OF 2


ANNEXURE-III

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 200KW *
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V ± 10%
- b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%
- c) Combined voltage & freq. variation : 10% (sum of absolute values)
- d) System fault level at rated voltage : 50 kA for 1 sec
- e) Short time rating for terminal boxes
- o 110 kW and above (Breaker : 50 KA for 0.25 sec. Controlled)
 - o Below 110 kW (Contactor : 50 KA protected by HRC fuse Controlled)
- f) LV System grounding : Solidly
- 5.0 Winding & Insulation : Class F with temp rise limited to class B
- 6.0 Minimum voltage for starting : 85% for motor ratings below 110kW
(As percentage of rated voltage) 80% for motor ratings from 110kW to 200kW.
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Earth Conductor Size & Material : Shall be given during detailed engg.
- 9.0 Space heater supply (for motors >=30kw) : 240 V, 1φ, 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.2 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : As per IS 12615
- 12.0 Makes : BHEL/ Customer approval (Package owner to take care)
- 13.0 Paint shade : Blue (RAL 5012) – Corrosion proof
- 14.0 Degree Of protection for motor/ terminal box : Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-
- i) Indoor motors - IP 54
- ii) Outdoor motors - IP 55
- iii) Cable box-indoor area - IP 54
- iv) Cable Box-Outdoor area - IP 55

*** LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615**

15.0 TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION


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	MOTORS	VOLUME II B
	DATA SHEET – C	SECTION D
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S. No.	Description	Data to be filled by successful bidder
A.	General	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	Design and Performance Data	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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	TITLE	SPECIFICATION NO.
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S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating ≥ 55 KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

34631/2020/PS-PEM-MAX



TITLE :
GENERAL TECHNICAL REQUIREMENTS
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

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

	TITLE :	SPECIFICATION NO.
	GENERAL TECHNICAL REQUIREMENTS	PE-SS-999-506-E101
	FOR	VOLUME NO. : II-B
	LV MOTORS	SECTION : D
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1.0 INTENT OF SPECIFICATION

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 machines
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.

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		SHEET : 3 OF 4

- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8. Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.



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 SECTION : **D**
 REV NO. : **00** DATE : 29/08/2005
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- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.
- 5.0 INSPECTION AND TESTING**
- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.
- 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**
- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.
 For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.



SUB-SECTION-V-QE1

MOTORS

**LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2**



QUALITY ASSURANCE

MOTOR

TESTS/CHECKS	Visual	Dimensional	Make/Type/Rating /General	Physical Inspection	Mech/Chem. Properties	NDT /DP/MP/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS-2148/IEC60034/IEC 60079-1/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										
Shaft	Y	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y	Y			Y			Y									
Rotor Copper/Aluminium	Y	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y	Y			Y		Y										
SC Ring	Y	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y	Y	Y	Y	Y			Y		Y										
Tubes, for Cooler	Y	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y	Y	Y	Y		Y	Y	Y										
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y				Y			Y	Y										



QUALITY ASSURANCE

CLAUSE NO.

Wound stator	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wound Exciter	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rotor complete	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Complete Motor	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y


Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.
 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
 3. Makes of major bought out items for HT motors will be subject to NTPC approval.
 4. Y1 = for HT Motor / Machines only.

TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC. NO. CS-0011-109(1A)-2

LOT-1A PROJECTS
FLUE GAS DESULPHURISATION SYSTEM PACKAGE

SUB-SECTION-V-QE1
MOTORS

PAGE 2 OF 2


	STANDARD QUALITY PLAN		SPEC. NO :	
	CUSTOMER :		QP NO.: PED-506-00-Q-006, REV-02	
	PROJECT:		DATE: 27.02.2020	
	ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		PO NO.:	
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		SYSTEM:		SECTION: II
				SHEET 1 OF 2

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check	Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY
1		3	4	5	6	7	8	9	**
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG. SPEC.	MFG. SPEC.	-DO-	P
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MFG. SPEC/ APPROVED DATASHEET	SAME AS COL.7	LOG BOOK	P
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST 2.OVERALL DIMENSIONS & ORIENTATION	MA	-DO- MEASUREMENT & VISUAL	100% 100%	IS-325 / IS-12815/ APPROVED DATA SHEET APPROVED DRG/DATA SHEET	SAME AS COL.7 APPROVED DRG/DATA SHEET	TEST/ INSPN. REPORT TEST/ INSPN. REPORT	P P

BHEL	
ENGINEERING	
Sign & Date	Name
<i>[Signature]</i>	Heema K.
Prepared by:	Checked by:
<i>[Signature]</i>	P. Dutta
Reviewed by:	Reviewed by:
<i>[Signature]</i>	<i>[Signature]</i>

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL	
Doc No:	
Sign & Date	Name
Reviewed by:	Seal
Approved by:	

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO. :	
			CUSTOMER :		QP NO.: PED-506-00-Q-006, REV-02	
			PROJECT:		DATE: 27.02.2020	
			ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SECTION: II	
		SYSTEM:		SHEET 2 OF 2		

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY	(# APPLICABLE FOR EXPORT JOBS)
					M	C/N						
1			4	5	100%	6	7	8	9		**	
		3.NAMEPLATE DETAILS	MA	VISUAL	100%		IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL.7	TEST/INSPN REPORT	D	M	C
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%		AS PER MFG. STANDARD / APPROVED PACKING DRAWING (#)	AS PER MFG. STANDARD / APPROVED PACKING DRAWING (#)	INSPC. REPORT	P	W	W


- NOTES:**
- 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON
 - 2 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.
 - 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
 - 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
 - 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL FOR REVIEW.
 - 6 IN CASE ,ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/CUSTOMER.

LEGENDS:
 *RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 D: DOCUMENT

FOR CUSTOMER REVIEW & APPROVAL		
Doc No:	Sign & Date	Name
Reviewed by:		Seal
Approved by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

BHEL			
ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
<i>[Signature]</i>	Hema K.	<i>[Signature]</i>	Kunal
Prepared by:		Checked by:	
Reviewed by:	P. Dutta	Reviewed by:	
	<i>[Signature]</i>		<i>[Signature]</i>

	STANDARD QUALITY PLAN		SPEC. NO.:
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		DATE: 27.02.2020	
CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04	
PROJECT:		PO NO.:	
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM: II	
		SHEET 1 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD				AGENCY	
					M	CAN			D	M	C	N		
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION 2.DIMENSIONS 3.PROOF LOAD TEST (EYE BOLT)	MA	VISUAL MEASUREMENT MECH. TEST	100% SAMPLE -DO-		MANUFACTURER'S DRG./SPEC -DO-	FREE FROM BLINKS, CRACKS, WAVINESS ETC MANUFACTURERS DRG./SPEC -DO-	LOG BOOK -DO- TEST REPORT -DO-	P P PV				
1.2	HARDWARES	1.SURFACE CONDITION 2.PROPERTY CLASS	MA	VISUAL VISUAL	100% SAMPLES		MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, UN-EVENNESS ETC MANUFACTURERS DRG./SPEC	SUPPLIERS TC & LOG LOG BOOK	P PV				PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION 2.CHEM. & PHY. PROP. 3.DIMENSIONS	MA	VISUAL CHEM & MECH TEST MEASUREMENT	100% 1/HEAT NO. 100%		MANUFACTURER'S DRG./SPEC MANUFACTURER'S DRG.	FREE FROM CRACKS, BLOW HOLES ETC MANUFACTURERS DRG./SPEC	SUPPLIERS TC LOG BOOK	PV PV				HEAT NO. SHALL BE VERIFIED
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS		MANUFACTURER'S DRG./SPEC	MANUFACTURERS DRG.	LOG BOOK LOG BOOK	PV PV				

FOR CUSTOMER REVIEW & APPROVAL			
Doc No.:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

BHEL		QUALITY	
ENGINEERING		SIGNATURE	
Sign & Date	Name	Sign & Date	Name
Prepared by: <i>P. Datta</i>	Hema K.	Checked by: <i>P. Datta</i>	<i>Hema K.</i>
Reviewed by: <i>P. Datta</i>	P. Datta	Reviewed by:	


STANDARD QUALITY PLAN	
CUSTOMER : PROJECT:	SPEC. NO.: QP NO.: PED-506-00-Q-007, REV-04 DATE: 27.02.2020 PO NO.: SHEET 2 OF 9 SYSTEM: II
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY					
					M	C/N				D	M	C	N		
1	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS	MA	VISUAL	100%	-	7	8	-DC-	-	-	-	-	-	-
15		1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG / SPEC.	FREE FROM VISUAL DEFECTS MANUFACTURERS DRG / STD.	SUPPLIERS TC	PV	-	-	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
18	SPACE HEATERS, CONNEXION BOXES, CABLES, CABLE LUGS, CARBON BRUSH TEMP DETECTORS, RTD, RTD'S	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/ CALIBRATION	MA CR MA MA MA	VISUAL -DC- -DC- MEASUREMENT TEST	100% -DC- -DC- SAMPLE 100%	100% - - - -	MANUFACTURER'S DRG / STD. ASTM-A388 MANUFACTURERS DRG / STD. MANUFACTURERS DRG / STD.	MANUFACTURERS DRG. MANUFACTURERS STD MANUFACTURERS DRG./STD. NO PHYS. DAMAGE. NO ELECTRICAL DISCONTINUITY MANUFACTURERS DRG. / STD. -DC-	LOG BOOK -DC- -DC- TEST REPORT	PV PV PV PV PV PV PV	- - - - - - -	- - - - - - -	- - - - - - -	- - - - - - -	FOR DIA OF 55 MM & ABOVE

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

BHEL			
ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
<i>Hema K. Gupta</i>	Hema K.	<i>15/02/2020</i>	<i>KUMAR</i>
Checked by:		Checked by:	
<i>P. Dutt</i>	P. Dutt	Reviewed by:	
Reviewed by:		Reviewed by:	


	STANDARD QUALITY PLAN		SPEC. NO.:	DATE: 27.02.2020
	CUSTOMER :		OP NO.: PED-506-00-0-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SECTION: II	
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			SYSTEM: II	
SHEET 3 OF 9				

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY		
					M	C/N				M	C	N
1			4	5	100%		7	8	9	D		
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA	VISUAL	SAMPLE	MANUFACTURERS STD.	NO VISUAL DEFECTS	TEST REPORT	PV			
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA	VISUAL	100%	MANUFACTURERS DRG.	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK AND OR SUPPLIERS TC	PV			
1.9	CONDUCTORS	1. SURFACE FINISH 2. ELECT. PROP. & MECH. PROP	MA	MEASUREMENT ELECT & MECH TESTS VISUAL	-DO- 100%	MANUFACTURERS DRG./ STD. SAMPLES	MANUFACTURERS DRG. / SPEC. FREE FROM VISUAL DEFECTS	-DO- SUPPLIERS TC LOG BOOK	PV PV PV			
<p>* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR DEFECTS ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.</p>												

FOR CUSTOMER REVIEW & APPROVAL	
Doc No:	
Sign & Date	Sign & Date
Reviewed by:	Reviewed by:
Approved by:	Approved by:

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

BHEL	
ENGINEERING	
Sign & Date	Sign & Date
Prepared by: <i>H. K. Sharma</i>	Checked by: <i>H. K. Sharma</i>
Reviewed by: <i>P. Datta</i>	Reviewed by: <i>P. Datta</i>
QUALITY	
Name	Name


	STANDARD QUALITY PLAN	SPEC. NO.:
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	CUSTOMER:	DATE: 27.02.2020
PROJECT:	PROJECT:	PO NO.:
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II
		SHEET 4 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY				
					M	CN				M	C	N		
1		3.DIMENSIONS	MA	MEASUREMENT	-	-	-DO-	-DO-	Log Book	D				
1.10	BEARINGS	1.MAKE & TYPE 2.DIMENSIONS	MA MA	VISUAL MEASUREMENT	100%	SAMPLE	MANUFACTURER'S DRG/ APPROVED DATASHEET	MANUFACTURER'S DRG/ APPROVED DATASHEET	-DO-	PV				
1.11	SLIP RING (WHEREVER APPLICABLE)	3.SURFACE FINISH 1.SURFACE COND. 2.DIMENSIONS	MA MA	VISUAL MEASUREMENT	100%	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	-DO-	PV				
1.12	OIL SEALS & GASKETS	3.TEMP WITH- STAND CAPACITY 4.HVIR 1.MATERIAL OF GASKET 2.SURFACE COND. 3.DIMENSIONS	MA MA MA MA	VISUAL MEASUREMENT ELECT TEST -DO-	100%	SAMPLE	MANUFACTURER'S DRG	MANUFACTURER'S DRG	-DO-	P				

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

BHEL			
ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
<i>[Signature]</i>	<i>[Name]</i>	<i>[Signature]</i>	<i>[Name]</i>
Prepared by:	Checked by:	Reviewed by:	
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	


	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN	SPEC. NO. :
CUSTOMER :		QP NO. : PED-505-00-Q-007, REV/04	DATE: 27.02.2020
PROJECT :		PO NO. :	
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM: II	SECTION: II
			SHEET 5 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY					
					M	C/N				D	M	C	N		
1	IN PROCESS		4	5	100%	-	7	8	9						
2.0	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		PW	-	-		
2.1		2.DIMENSIONS	MA	MEASUREMENT	-DO-	-	MANUFACTURER'S DRG	MANUFACTURERS DRG	-DO-		P	-	-		
2.2	MACHINING	1.FINISH 2.DIMENSIONS	MA	VISUAL MEASUREMENT	100%	-	-DO-	GOOD FINISH MANUFACTURERS DRG	LOG BOOK -DO-		P	-	-		
2.3	PAINING	3.SHAFT SURFACE FLOWS 1.SURFACE PREPARATION 2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT) 3.SHADE 4.ADHESION	MA	PT VISUAL MEASUREMENT BY ELCOMETER VISUAL CROSS CUTTING & TAPE TEST	100%	100%	MANUFACTURER'S STD./ASTM-E165 MANUFACTURERS STD./APPROVED DATASHEET	MANUFACTURERS STD./APPROVED DATASHEET. SAME AS COL.7	-DO- LOG BOOK		P P	V -	- -		

BHEL		QUALITY	
ENGINEERING	Name	Sign & Date	Name
Prepared by: <i>[Signature]</i>	Hema K.	<i>[Signature]</i>	KUNAL
Reviewed by: <i>[Signature]</i>	P. Dutta	<i>[Signature]</i>	GABRIEL

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL	
Doc No:	
Sign & Date	Name
Reviewed by:	Seal
Approved by:	

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN	SPEC. NO.: QP NO.: PED-506-00-Q-007, REV/04 DATE: 27.02.2020
CUSTOMER :		PO NO.:	
PROJECT:		SYSTEM:	
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LY (415V))		SECTION: II SHEET 6 OF 9	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY				
					M	CN				M	C	N		
1			4	5	6	7	8	9						
2.4	SHEET STACKING	1.COMPLETENESS 2.COMPRESSION & TIGHTENING	MA MA	MEASUREMENT MEASUREMENT	SAMPLE 100%	MANUFACTURER'S STD. -DO-	MANUFACTURERS STD.	LOG BOOK LOG BOOK	P P					
2.5	WINDING	1.COMPLETENESS 2.CLEANLINESS 3.IR-HV-IR 4.RESISTANCE 5.INTERTURN INSULATION	CR CR CR CR CR	VISUAL -DO- ELECT. TEST -DO- -DO-	100% 100% -DO-	MANUFACTURER'S STD/APPROVED DATASHEET -DO- IS-325/IS-12615/IEC-60034 PART-1 IS-325/IS-12615/IEC-60034 PART-1 -DO-	MANUFACTURERS STD/APPROVED DATASHEET -DO- IS-325/IS-12615/IEC-60034 PART-1 IS-325/IS-12615/IEC-60034 PART-1 -DO-	LOG BOOK LOG BOOK LOG BOOK LOG BOOK	P P P P					
2.6	IMPREGNATION	1.VISCOSITY 2.TEMP. PRESSURE VACUUM 3.NO. OF DIPS	MA MA MA	PHY. TEST PROCESS CHECK -DO-	AT STARTING CONTINUOUS CONTINUOUS	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFRR'S STANDARD MANUFACTURERS STANDARD MANUFACTURERS STANDARD	LOG BOOK LOG BOOK LOG BOOK	P P P					THREE DIPS TO BE GIVEN

BHEL		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL	
ENGINEERING		QUALITY		Doc No:	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Name
<i>[Signature]</i>	Mema K.	<i>[Signature]</i>	<i>[Signature]</i>		Seal
Prepared by:	Checked by:	Reviewed by:	Reviewed by:		
<i>[Signature]</i>	P. Dulla	<i>[Signature]</i>	<i>[Signature]</i>		


STANDARD QUALITY PLAN	
CUSTOMER : PROJECT:	SPEC. NO.: QP NO.: FED-506-00-Q-007, REV-04 DATE: 27.02.2020 PO NO.: SHEET 7 OF 9
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LY (415V)) SYSTEM:	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
					M	CIN				D	M	C	N
1			4	5	6	7	8	9					
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA	-DO- VISUAL	CONTINUOUS 100%	-DO- -DO-	-DO- -DO-	LOG BOOK	✓	P	V	-	-
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR	-DO- MALLET TEST & UT	-DO- 100%	-DO- 100%	-DO- -DO-	LOG BOOK	✓	P	V	-	-
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE	MA	ELECT. TEST DYN BALANCE	100% -DO-	-DO- MANUFACTURER'S SPEC / ISO 1940	-DO- MANUFACTURER'S DWG.	LOG BOOK	✓	P	V	-	-
2.10	ASSEMBLY	2.SOUNDNESS OF DIE CASTING 1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS	CR	ELECT. (GROWLER TEST) MEAS. VISUAL MEAS.	100% -DO- -DO- 100%	MANUFACTURER'S SPEC. -DO- -DO- -DO- MANUFACTURER'S DRG / MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC. -DO- -DO- -DO- MANUFACTURER'S DRG / RELEVANT IS	LOG BOOK	✓	P	V	-	-
		5.CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, 8TD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✓	P	V	-	-

FOR CUSTOMER REVIEW & APPROVAL	
Doc No:	
Reviewed by:	Sign & Date
Approved by:	Name Seal


BIDDER/ SUPPLIER	
Sign & Date	
Seal	

BHEL	
ENGINEERING	
Prepared by:	Checked by:
Reviewed by:	Reviewed by:
QUALITY	
Sign & Date	Sign & Date
Name	Name

		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS CUSTOMER : PROJECT : ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		STANDARD QUALITY PLAN		SPEC. NO.: QP NO.: PED-506-00-Q-007, REV-04 PO NO.: DATE: 27.02.2020	
				SYSTEM:		SECTION: II	
				SHEET 8 OF 9		SHEET 8 OF 9	
				SYSTEM:		SECTION: II	

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD			AGENCY		
					M	CN			D	M	C	N		
1	TESTS	1. TYPE TESTS INCLUDING SPECIAL TESTS 2. ROUTINE TESTS INCLUDING SPECIAL TEST 3. VIBRATION & NOISE LEVEL 4. OVERALL DIMENSIONS AND ORIENTATION 5. DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & RTD 7. MEASUREMENT OF RESISTANCE IR OF SPACE HEATER 8. NAME PLATE DETAILS 9. EXPLOSION FLAME PROOFNESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	4	5	100%	100%	IS-325/IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	P	W*	W*	* NOTE - 1	
3.0			MA	MEASUREMENT & VISUAL	100%	100%	IS-12075 / IEC 60034-14 & IS-12085	IS-12075 / IEC 60034-14 & IS-12085	-DO-	P	V/W*	V/W*	* NOTE - 2	
			MA	ELECT. & MECH. TEST	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & APPROVED DATASHEET	TEST/INSPEC. REPORT	P	W	W		
			MA	EXPLOSION FLAME PROOF TEST	100%	100%	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	P	V	V	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3	
			MA	MEASUREMENT OF RESISTANCE OF RTD	100%	100%	IS-325/IS-12615/IEC-60034 PART-1/IS-12082	IS-325/IS-12615/IEC-60034 PART-1/IS-12082	-DO-	P	V/W*	V/W*	* NOTE - 2	
			MA	MEASUREMENT OF RESISTANCE IR OF SPACE HEATER	100%	100%	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	-DO-	P	V/W*	V/W*	* NOTE - 2	
			MA	VISUAL	100%	100%	IS-325/IS-12615 & DATA SHEET	IS-325/IS-12615 & DATA SHEET	TEST/INSPEC. REPORT	P	V/W*	V/W*	* NOTE - 2	
			MA	EXPLOSION FLAME PROOF TEST	100%	100%	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	P	V	V	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3	
			MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	P	W*	W*	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY * NOTE - 2	

ENGINEERING Sign & Date: <i>[Signature]</i> / 27/02/2020 Prepared by: <i>[Signature]</i> Reviewed by: <i>[Signature]</i>		BHEL Name: <i>[Signature]</i> Checked by: <i>[Signature]</i> Reviewed by: <i>[Signature]</i>		QUALITY Sign & Date: <i>[Signature]</i> / 27/02/20 Name: <i>[Signature]</i>	
BIDDER/SUPPLIER Sign & Date: _____ Seal: _____		FOR CUSTOMER REVIEW & APPROVAL Doc No: _____ Sign & Date: _____ Name: _____ Seal: _____ Reviewed by: _____ Approved by: _____			

		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO.:					
				CUSTOMER :		QP NO.: PEB-506-00-Q-007, REV-04		DATE: 27.02.2020			
				PROJECT:		PO NO.:					
				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		SECTION: II		SHEET 9 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY
1	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION DRAWING.	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION DRAWING.	INSPEC. REPORT	M P C W
4.0										

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE. THESE TEST MAY NOT BE REPEATED
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
- 6 IN CASE, ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/CUSTOMER.


LEGENDS:


- *RECORDS, IDENTIFIED WITH TICK(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
- ** M: SUPPLIER/MANUFACTURER/SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
- MA: MAJOR, MI: MINOR, CR: CRITICAL
- D: DOCUMENT


ENGINEERING		BHEL		QUALITY	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Name
<i>[Signature]</i>	Hema K.	<i>[Signature]</i>	Kumar	<i>[Signature]</i>	Gandhi
Prepared by:		Checked by:		Reviewed by:	
Reviewed by:		Reviewed by:		Reviewed by:	


BIDDER/ SUPPLIER	
Sign & Date	
Seal	


FOR CUSTOMER REVIEW & APPROVAL			
Doc No:		Sign & Date	Name
Reviewed by:			Seal
Approved by:			


CLAUSE NO.	TECHNICAL REQUIREMENTS	
2.01.06	<p>Boiler Area</p> <p>Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with SG/ESP contractor.</p> <p>Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in boiler/ESP area.</p>	
2.01.07	<p>Two separate cable routes shall be provided for cable routing of working and standby drives or different set/group (say 50% capacity) of auxiliaries.</p>	
2.01.08	<p>OffSite Area</p> <p>For feeder in bidder's scope for offsite areas, overhead cable tray arrangement shall be followed. However cable trenches/slit may also be acceptable, for some areas, if found to be required during detailed engineering.</p> <p>Cable trenches provided shall be separated from fuel oil area to avoid oil accumulation.</p>	
2.01.09	<p>The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.</p>	
2.01.10	<p>Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.</p>	
2.01.11	<p>Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:</p> <ul style="list-style-type: none"> • Meet all safety requirements • Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc 	
3.00.00	<p>EQUIPMENT DESCRIPTION</p>	
3.01.00	<p>Cable trays, Fittings & Accessories</p>	
3.01.01	<p>Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.</p>	
3.01.02	<p>Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter.</p>	
3.01.03	<p>Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.</p>	
3.01.04	<p>Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanized as per Clause No. 3.13.00 of this chapter. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.</p>	
3.01.05	<p>The tolerance for cable tray and accessories shall be as per IS 2102 (Part-1). Tolerance Class: - Coarse</p>	
<p>LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p> <p>Page 3 of 69</p>


CLAUSE NO.	TECHNICAL REQUIREMENTS	
<p>3.02.00</p> <p>3.02.01</p> <p>3.02.02</p> <p>3.02.03</p>	<p>Support System for Cable Trays</p> <p>Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.</p> <p>Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder</p> <ol style="list-style-type: none"> a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised. c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation. e. The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079. f. Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position. g. Support system shall be able to withstand <ul style="list-style-type: none"> • weight of the cable trays • weight of the cables (75 Kg/Metre run of each cable tray) • Concentrated load of 75 Kg between every support span. • Factor of safety of minimum 1.5 shall be considered. <p>The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to</p>	
<p>LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p> <p>Page 4 of 69</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<p>the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.</p>	
3.02.04	<p>Four legged structure shall be provided wherever there is change in elevation and change in direction</p>	
3.02.05	<p>FOR COAL HANDLING PLANT/FGD PLANT AREA THE FOLLOWING SHALL ALSO BE APPLICABLE:</p> <p>a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route.</p> <p>b) Cable trenches shall be provided only in Switchgear/MCC rooms.</p> <p>c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc.</p> <p>d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.</p>	
3.03.00	<p>Pipes, Fittings & Accessories</p>	
3.03.01	<p>Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria</p>	
3.03.02	<p>GI Pipes shall be of medium duty as per IS: 1239</p>	
3.03.03	<p>Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.</p>	
3.03.04	<p>Hume pipes shall be NP3 type as per IS 458.</p>	
3.03.05	<p>TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures</p>	
3.03.06	<p>HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 part-I.</p>	
3.04.00	<p>Junction Boxes</p>	
3.04.01	<p>Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of</p>	
<p>LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p> <p>Page 5 of 69</p>

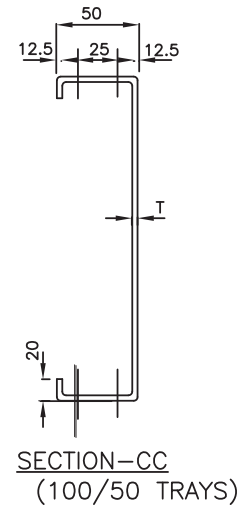
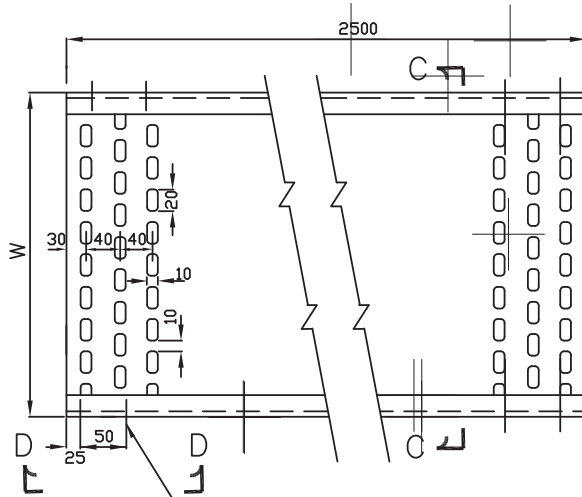
CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:-</p> <p>(a) Impact resistance for impact energy of 2 Joules (IK07) as per BS EN50102</p> <p>(b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb.</p> <p>(c) Class of protection shall be IP 55.</p> <p>(d) HV test.</p>		
3.04.02	<p>Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.</p>		
3.05.00	<p>Terminations & Straight Through Joints</p>		
3.05.01	<p>Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE –A-51-RA of cable lug attached at the end of this chapter).</p>		
3.05.02	<p>Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design</p>		
3.05.03	<p>1.1 KV grade Straight Through Joint shall be of proven design.</p>		
<p>LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p>	<p>Page 6 of 69</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.06.00	Cable glands		
3.06.01	Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.		
3.07.00	Cable lugs/ferrules		
3.07.01	Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to IS/DIN standards.		
3.08.00	Trefoil clamps		
3.08.01	Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.		
3.09.00	Cable Clamps & Ties		
3.09.01	The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyester coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.		
3.10.00	Receptacles		
3.10.01	Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity ranging from 30-300 mA .		
3.11.00	Cable Drum Lifting Jack The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for		
<p align="center">LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p align="center">SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p>	<p align="center">Page 7 of 69</p>

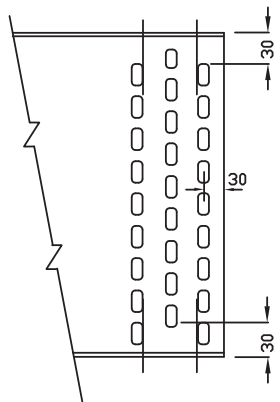
CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation.</p>		
3.12.00	<p>Galvanising</p>		
3.12.01	<p>Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.</p>		
3.12.02	<p>The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified</p>		
3.13.00	<p>Welding</p>		
3.13.01	<p>The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595</p>		
4.00.00	<p>INSTALLATION</p>		
4.01.00	<p>Cable tray and Support System Installation</p>		
4.01.01	<p>Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.</p>		
4.01.02	<p>Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.</p>		
4.01.03	<p>The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.</p>		
4.01.04	<p>The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.</p>		
4.01.05	<p>All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.</p>		
4.01.06	<p>In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the</p>		
<p>LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p>	<p>Page 8 of 69</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS											
	<p>prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.</p>											
4.02.00	<p>Conduits/Pipes/Ducts Installation</p>											
4.02.01	<p>The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.</p>											
4.02.02	<p>GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.</p>											
4.02.03	<p>Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material</p>											
4.02.04	<p>Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise</p> <table border="1" data-bbox="402 793 954 1056"> <thead> <tr> <th>Conduit /pipe size (dia).</th> <th>Spacing</th> </tr> </thead> <tbody> <tr> <td>Upto 40 mm</td> <td>1 M</td> </tr> <tr> <td>50 mm</td> <td>2.0 M</td> </tr> <tr> <td>65-85 mm</td> <td>2.5 M</td> </tr> <tr> <td>100 mm and above</td> <td>3.0 M</td> </tr> </tbody> </table>	Conduit /pipe size (dia).	Spacing	Upto 40 mm	1 M	50 mm	2.0 M	65-85 mm	2.5 M	100 mm and above	3.0 M	
Conduit /pipe size (dia).	Spacing											
Upto 40 mm	1 M											
50 mm	2.0 M											
65-85 mm	2.5 M											
100 mm and above	3.0 M											
4.02.05	<p>For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.</p>											
4.03.00	<p>Junction Boxes Installation</p>											
4.03.01	<p>Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.</p>											
4.04.00	<p>Cable Installation</p>											
4.04.01	<p>Cable installation shall be carried out as per IS:1255 and other applicable standards.</p>											
4.04.02	<p>For Cable unloading, pulling etc following guidelines shall be followed in general:</p> <p>a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.</p>											
<p>LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p> <p>Page 9 of 69</p>										

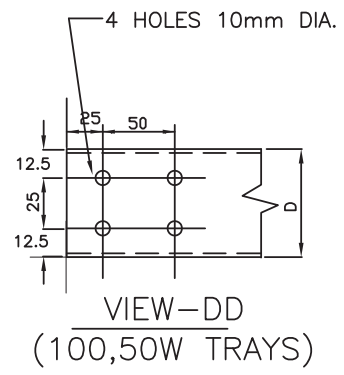
34631/2020/PS-PEM-MAX



4 HOLES 10mm DIA.



ARRANGEMENT OF PERFORATIONS



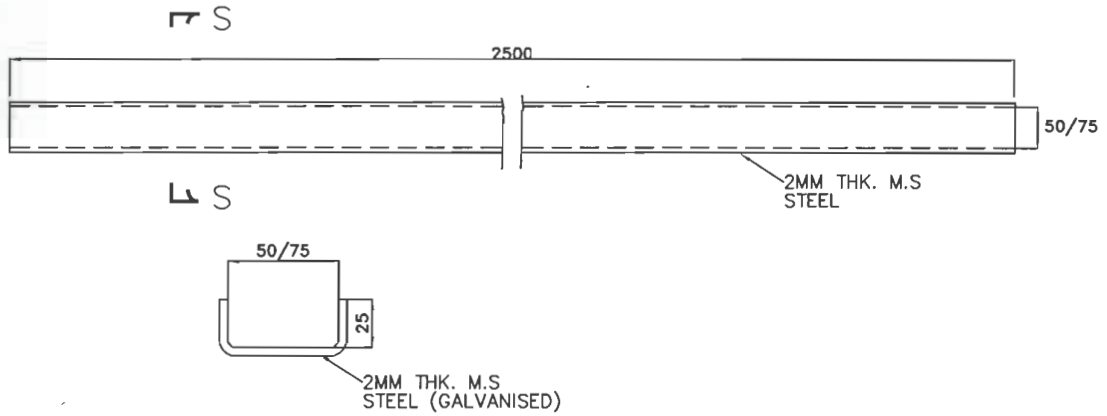
TRAY WIDTH W (mm)	100	50
TRAY DEPTH D (mm)	50	50
T (mm)	2	2

PERFORATED TYPE TRAY



TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES

DWG. NO.



SECTION S-S

CABLE TROUGHS

SEE GENERAL NOTES IN SHEET 11.




TYPICAL DETAILS OF
CABLE TRAY AND ACCESSORIES

BHEL DRAWING NO.
PE-DG-427-507-E005

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REV 00


	3X660 MW NABINAGAR TPP (FGD System Package) HVAC SYSTEM TECHNICAL SPECIFICATION (C&I PORTION)	SPECIFICATION No: PE-TS-457-(571-13000-A)-A001	
		SECTION : I	
		SUB-SECTION : C-4	
		REV. 00	

SECTION: I

SUB-SECTION: C-4
TECHNICAL SPECIFICATION (C&I PORTION)

	3X660 MW NPGCPL & 4X250 MW BRBCL NABINAGAR - FGD	SECTION: C
	TECHNICAL REQUIREMENTS (C&I) HVAC SYSTEM	

**TECHNICAL SPECIFICATION
(CONTROL AND INSTRUMENTATION)
FOR HVAC SYSTEM**

				
	3X660 MW NPGCPL & 4X250 MW BRBCL NABINAGAR - FGD	DESG	KKM	
	JOB NO: 457 & 463	CHKD	KKM	
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**C&I SPECIFICATION FOR
HVAC SYSTEM**

SECTION: C
SUB SECTION: C&I

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**C&I SPECIFIC TECHNICAL REQUIREMENT
FOR DCS BASED HVAC SYSTEM**



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Specific Technical Requirements (C&I):

- 1.0 Air Conditioning and Ventilation System shall be operated from DDCMIS (BHEL's scope) for Area's/Building indicated elsewhere in the specification.
- 2.0 Interface of MCC, field Equipment, Actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy enclosed in specification.
- 3.0 Microprocessor based controls of Air cooled condensing unit (D-X type), PAC (if applicable) etc. shall be provided with local display along with facilities to Soft link & Hardwired interface with DDCMIS and to meet the requirement of all system operations and controls. Soft link communication between Microprocessor (MP) based control panels & DDCMIS shall be redundant Bi-directional via TCP/IP on OPC or MODBUS with RS485 link. Bidder shall include required hardware at MP end.
- 4.0 Time synchronization of MP with DCS is to be carried out. Necessary hardware/software for same at MP end to be provided by Bidder
- 5.0 Bidder to supply all the instruments required for the package along with necessary fittings, accessories and valve manifold etc. for control monitoring and operation of HVAC system. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.
- 6.0 All the Electronic Transmitter for Pressure, Temperature, Differential Pressure and DP based Flow /Level measurements shall be genuine, verifiable PROFIBUS PA protocol compatible instruments. The transmitters shall be connected to DDCMIS through PROFIBUS PA protocol complying to IEC 61158 directly from transmitter. This is subject to customer approval and BHEL decision shall be final.
- 7.0 The PROFIBUS protocol design shall be further validated by BHEL and approved by NTPC during detailed engineering and any variation/ changes required based on DDCMIS system requirements and actual field installation, operational philosophy etc. shall be considered by bidder without any implications.
- 8.0 All transmitters (except PROFIBUS PA compatible transmitters) shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART).
- 9.0 All the transmitters supplied by Bidder shall be rack mounted. The transmitter racks shall be in Bidder's scope of supply.



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- 10.0 All Temperature sensors shall be Duplex type and temperature transmitter shall be provided for all temperature measurement applications. Bidder to provide temperature transmitter along with compensating cable, JB/Rack & other erection hardware.
- 11.0 Use of process actuated switch shall be avoided unless unavoidable.
- 12.0 All transmitters shall be suitably grouped together and mounted inside (i) Local Instruments Enclosures (LIEs) in case of open areas of the plant and (ii) In Local Instrument Racks (LIRs) in case of covered areas.
- 13.0 All field instruments enclosure shall be IP65, local panel/cabinet enclosure shall be IP 55, unless otherwise specified.
- 14.0 All instruments (except PROFIBUS PA compatible transmitters) and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.
- 15.0 Electrical Actuators (as applicable) shall be Non-Intrusive type electric actuators envisaged with integral starter. The interface of these actuators with DCS shall be of two types viz. with Hardwired interface and with PROFIBUS DP interface. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication shall be available integral to actuator body. Open/Close command termination logic suitably built inside the actuator Details shall be referring in the specification.
- 16.0 All ON, OFF, INCHING Type electric actuators shall be PROFIBUS DP compatible. However, the exact protocol shall be based on finalized protocol of DCS. If PROFIBUS DP protocol is envisaged, then actuator shall have two (redundant) PROFIBUS DP ports for connecting the redundant PROFIBUS DP cables. That is if one PROFIBUS DP cable is cut or not working/not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention.
- 17.0 AHU shall be started either locally or from the main FGD control room by means of Remote / Manual selection facility.
- 18.0 Local control panel if any required for operation shall be in bidder scope.



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- 19.0 LCP (If applicable) shall have the provision of command (start/stop) & feedback interface with plant FGD-DCS
- 20.0 Relative humidity and temperature measurement of all control rooms and all major air-conditioned areas shall made be available in FGD control system.
- 21.0 VFD panels for applicable drives are in Bidders scope. Typical signal exchange with DCS has been indicated in the specification elsewhere.
- 22.0 Drive control philosophy/signal exchange list attached elsewhere in the specification are Tentative. Shall be finalized during detailed engineering.
- 23.0 Bidder to include IO from fire protection system (supplied by others) for closing the dampers in the event of fire, the no of IO & other specifications in this regard shall be finalized during detail engineering.
- 24.0 Complete C&I system for Air Conditioning and Ventilation System is in bidder's scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder without any commercial implication.
- 25.0 The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire Air Conditioning and Ventilation System. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.
- 26.0 The quantity of instruments for the system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
- 27.0 Bidder to furnish electrical load/UPS load data during detailed engineering



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- 28.0 415V AC/ 230V UPS Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board, changeover circuit in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid.
- 29.0 Power supply derived for contact interrogation, interposing relay and solenoid shall generally be ungrounded 24 V D.C. only.
- 30.0 The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering. The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation, a No deviation certificate is to be furnished.
- 31.0 The make of the items shall be from sub-vendor list. However, the make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 32.0 The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards.
- 33.0 Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication
- 34.0 The scope of cable shall be referred in Electrical scope split sheet in Electrical portion of the specification.
- 35.0 Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection (DCS end terminal details shall be provided to vendor during detail engineering to incorporate in cable interconnection), JB grouping, Annunciation list, SOE list, List of Instruments/devices for in BHEL approved format. Also reusable database format like MS Excel, MS Access etc. of these documents



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shall also be provided by Contractor in BHEL approved format. Soft copy of the formats shall be provided to the successful bidder

- 36.0 Instrument installation and accessories required for the same shall be in Bidder's scope and shall be subject to customer/BHEL's approval during detailed engineering.
- 37.0 Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.
- 38.0 Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
- 39.0 Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.
- 40.0 To ensure availability, adequate redundancy in system design shall be provided at hardware, software and sensor level. For the protection system, independent sensing device shall be provided to ensure adequate safety of plant equipment.
- 41.0 Redundancy of sensors shall be provided by bidder
(i) Triple redundancy for all analog and binary inputs required for protection of system/drives.
(ii) For all other control functions dual redundancy of the sensors shall be provided by the bidders.
- 42.0 The design of the control systems and related equipment shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved and shall not cause a hazardous condition. However, it shall also be ensured that occurrence of false trips are avoided/ minimized.
- 43.0 All panels, cabinets shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels. The system ground shall be isolated from the panel ground with suitable isolators. All internal component grounds or common shall be connected to the system ground, which shall be fabricated of copper flat (size 25mm x 6mm min., length as applicable).



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- 44.0 The requirements given are to be read in conjunction with detailed Technical specification enclosed.
- 45.0 The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation, a "No deviation" certificate is to be furnished.
- 46.0 All the instruments/equipments/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply
- 47.0 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.
- 48.0 For instruments which are not located inside covered building, suitable canopy/ protective arrangement shall be provided which shall be approved during detail engineering.
- 49.0 All the wetted parts of the instruments including the accessories like root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments as well as valves shall be of SS-316 material, suitable pressure class and same shall be in bidder's scope .
- 50.0 All instruments should be supplied with valid calibration and test certificates provided by OEM.
- 51.0 The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback.
- 52.0 Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument."
- 53.0 At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc.
- 54.0 The contacts of equipment mounted instruments; sensors, switches etc. For external connection including spare contacts shall be wired out to suitably located junction boxes by bidder.



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- 55.0 Double root valve shall be provided for all pressure tapings where the design pressure exceeds 40kg/cm².
- 56.0 All the instruments PG/DPG/DPT/PT etc. (as applicable) having contact with corrosive media shall be provided with chemical/diaphragm seal.
- 57.0 Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
- 58.0 Bidder's presence is required for minimum 09 Man days (in three visits, excluding travel time) at site in which each visit shall be of minimum 03 Man days during commissioning of DCS for assistance related to process correctness. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
- 59.0 Bidder's representative (process/ C&I owner) shall be present at BHEL-PEM Office for minimum 03 man-days, for preparation of Control scheme and operation and control philosophy of AC and ventilation system. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope
- 60.0 Number of pairs to be selected for Screen/ Control cable
 (a) F-Type: 2P/4P/8P/12P(Size : 0.5 mm²)
 (b) G-Type: 2P/4P/8P/12P(Size : 0.5 mm²)
 (c) Core Cable: 3CX2.5sqmm²/ 5CX2.5sqmm²/ 12CX1.5sqmm²
- 61.0 Bidder to provide mandatory spares as per mandatory spares list. Attached elsewhere in the specification.



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62.0 Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract: List of Drawings/Documents and data to be furnished by bidder after award of the contract are mentioned under section "List Of Documents/Deliverables".

- GA & wiring diagram of local panel.
- Power requirement.
- Local control panel & instruments data sheet.
- Instrument schedule
- Alarm Schedule
- Control scheme
- Control write-up
- Any other document decided during detailed engineering

Note:-

1. All equipment items shall be of latest design with proven on track record.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.




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**GENERAL TECHNICAL REQUIREMENTS
(HVAC SYSTEM)**

FORM NO. PEM-6666-0


	SPECIFICATION FOR CONTROL & INSTRUMENTATION FOR AUX PACKAGES	SPECIFICATION NO.:	
		VOLUME	
		SUB SECTION	
		REV. NO.	DATE :
		SHEET	OF
<p>GENERAL REQUIREMENT</p> <p>1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.</p> <p>2.0 The quantity of instruments for auxiliary system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.</p> <p>3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.</p> <p>4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.</p> <p>5.0 The customer specification attached as Specific Technical Requirement will supercede the Data sheets, if there is any mismatch.</p>			



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**SPECIFICATION FOR MEASURING INSTRUMENTS
(PRIMARY & SECONDARY), VFD, ELECTRICAL
ACTUATOR AND LCP.**

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)			
1.01.00	Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.			
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.			
1.03.00	All transmitters, sensors, switches and gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.			
1.04.00	The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.			
1.05.00	<p>All instruments envisaged for sea water applications, shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by contractor).</p> <p>For Chlorine application: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Hastelloy C. Also, filled liquid shall be Fluorolube oil/ Inert Hydrocarbon / CTFE etc., for these applications.</p> <p>For applications of FECL3 solution: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Tantalum.</p>			
1.06.00	For coastal areas, all instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.			
1.07.00	The instruments, for which technical specification is not attached, shall be supplied as per the standard and proven practice of the contractor. The same shall be established by the contractor during detailed engineering by providing detailed explanation/concepts, if required by the employer, of such implementation along with standard documentation.			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1)-2	SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 1 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC							
16.00.00	<p>FIELD INSTRUMENTS BASED ON FIELDBUS</p> <p>The following instruments shall be connected to DDCMIS through fieldbus i.e. FOUNDATION Fieldbus/PROFIBUS PA protocol complying to IEC 61158 directly from transmitter.</p>								
16.01.00	<p>Electronic Transmitter for Pressure, Differential Pressure and DP based Flow / Level measurements.</p> <table border="1" data-bbox="389 1470 1380 1596"> <thead> <tr> <th data-bbox="389 1470 487 1512">S No.</th> <th data-bbox="487 1470 747 1512">Features</th> <th data-bbox="747 1470 1380 1512">Essential/Minimum Requirements</th> </tr> </thead> <tbody> <tr> <td data-bbox="389 1533 487 1596">1.</td> <td data-bbox="487 1533 747 1596">Type of Transmitter</td> <td data-bbox="747 1533 1380 1596">FOUNDATION Fieldbus/PROFIBUS PA based output</td> </tr> </tbody> </table>	S No.	Features	Essential/Minimum Requirements	1.	Type of Transmitter	FOUNDATION Fieldbus/PROFIBUS PA based output		
S No.	Features	Essential/Minimum Requirements							
1.	Type of Transmitter	FOUNDATION Fieldbus/PROFIBUS PA based output							
<p align="center">LOT-1A PROJECTS, FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-0011-109(1A)-2</p>	<p align="center">PART-B SUB-SECTION-III-C2 MEASURING INSTRUMENTS</p>	<p align="center">PAGE 5 OF 8</p>						