

SUB-SECTION - E-47

QA – CIVIL WORKS

CLAUSE NO.	 Quality Assurance for Civil Works 		
	<u>QUALITY ASSURANCE AND INSPECTION FOR CIVIL WORKS</u> 1.0.0 INTRODUCTION 1.1.0 This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works covered in this specification. 1.2.0 This part of the technical specification shall be read in conjunction with other parts of the technical specifications, general technical requirements & erection conditions of the contract. Wherever IS code or standards have been referred they shall be the latest revisions. 1.3.0 The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part of the technical specifications. The QA and QC activities in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / contract documents shall be carried out at no extra cost to the owner. 1.4.0 The contractor shall prepare detailed construction and erection methodology scheme which shall be compatible to the requirements of the desired progress of work execution, quality measures, prior approvals if any and the same shall be got approved by the Engineer. If required, work methodology may be revised/ reviewed at every stage of execution of work at site, to suit the site conditions by the contractor at no extra cost to the owner. 2.0.0 QUALITY ASSURANCE PROGRAMME 2.1.0 The contractor shall adopt suitable Quality Assurance Programme (QAP) to ensure that the equipments and services under the scope of contract whether manufactured or performed within contractor's works or at his sub-contractor's premises or at the OWNER's site or at any other place of work are in accordance with the specifications. Such QAP shall be outlined by the contractor and shall be finally accepted by the OWNER or their authorized representative after discussions before the start of work. The QAP shall be generally in line with IS/ISO Systems. The contractor shall furnish complete QA & QC programme for the work envisaged which may include the following • Organization structure for the management and implementation of the proposed quality assurance programme • Quality System Manual		
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	• Design Control System • Documentation and Data Control System • Qualification data / details for Contractor's key personnel • The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased, etc. • System for shop manufacturing and site erection controls including process, fabrication and assembly • Control of non-conforming items and system for corrective actions and resolution of deviations • Inspection and test procedure both for manufacture and field activities • Control of calibration and testing of measuring testing equipment • System for Quality Audits • System for identification and appraisal of inspection status • System for authorizing release of manufactured product to the OWNER • System for handling, storage and delivery • System for maintenance of records • Quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of work/ equipment/component.		
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3.0.0	QA AND QC MANPOWER		
3.1.0	The contractor shall nominate one overall QA coordinator for the contract detailing the name, designation, contact details and address at the time of post bid discussions. All correspondence related to Quality Assurance shall be addressed by the contractor's QA coordinator to OWNER. OWNER shall address all correspondence related to Quality issues to the contractor's QA coordinator. The contractor's QA coordinator shall be responsible for co-ordination of Quality activities between various divisions of the contractor and their sub-vendors on one hand & with OWNER on the other hand.		
3.2.0	The contractor shall appoint a dedicated, experienced and competent QA&QC in-charge at site, preferably directly reporting to the Project Manager, supported as necessary by experienced personnel, to ensure the effective implementation of the approved QAP. An indicative structure of contractor's QA&QC manpower required to be deployed at site is enclosed at Annexure-I . Based on the finalized L-2 network and the approved Field Quality plan, the contractor shall finalize and submit a deployment schedule of QA&QC personnel along with their details to OWNER for approval/ acceptance and further shall ensure their availability well before the start of the concern activity.		
3.3.0	The QA&QC in-charge shall have the organizational freedom and authority to implement the requirements of these quality assurance arrangements, free from commercial and programme restraints. The QA&QC setup of the contractor shall consist of qualified and experienced Civil, Electrical, Mechanical Engineers and Laboratory assistants with their supporting staff both at their works and site.		
3.4.0	The deployment of man power for QA & QC set up shall be affected on the basis of agreed manpower deployment schedule, which shall be prepared by the contractor based on the L-2 network and the same shall be submitted to the engineer-in-charge for acceptance.		
4.0.0	SAMPLING AND TESTING OF CONSTRUCTION MATERIALS		
4.1.0	The method of sampling for testing of construction materials and work / job samples shall be as per the relevant IS / standards / codes and in line with the requirements of the technical specifications / quality plans. All samples shall be jointly drawn, signed and sealed wherever required, by the contractor and the engineer or his authorized representative.		
4.2.0	The contractor shall carry out testing in accordance with the relevant IS / standards / codes and in line with the requirements of the technical specifications / quality plans. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer. All testing shall be done in the presence of the engineer or his authorized representative.		
4.3.0	Before execution of any civil work the contractor shall conduct full-scale suitability tests on various construction and building material such as fine and coarse aggregates, cement, reinforcement, construction chemicals, supplementary cementitious materials and construction water to ascertain their suitability for use and the concrete mix designs conducted from reputed institutes such as NCB-Ballabgarh, CSMRS-Delhi, selected		
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	IIT's, etc. as agreed by the engineer. A list of OWNER acceptable specialist laboratories is enclosed at Annexure-II. The test samples for such full scale testing shall be jointly sampled and sealed by the engineer and contractor, thereafter these shall be sent to the concerned laboratory through the covering letter signed by field quality assurance (FQA) representative of the engineer. Format for sampling and testing of cement, coarse aggregate, fine aggregate, chemical admixture, fly ash, water, concrete mix design is enclosed at Annexure-III.		
4.4.0	The contractor shall timely initiate the action with regard to the evaluation of aggregates and other building material including concrete mix design, so as to ensure completion of these tests before start of civil works at site, thereby not affecting any project work. The test reports and recommendations for suitability of the materials including concrete mix design shall be promptly submitted by the contractor to the engineer.		
4.5.0	Evaluation of aggregate for potential alkali-aggregate reactivity shall be carried out as per following scope of work A. Evaluation of Aggregates for Mechanical / Physical Properties a) To carry out different tests on coarse aggregate sample i.e. specific gravity, water absorption, sieve analysis, deleterious material; soundness, crushing value, impact value, abrasion value, elongation index and flakiness index, as per IS: 2386. b) To carry out different tests on fine aggregate sample i.e. specific gravity, water absorption, sieve analysis, deleterious material, soundness, silt content, clay content and organic impurities as per IS: 2386. c) To prepare evaluation report based on test results of a) and b) above and to advise regarding suitability of fine and coarse aggregates. B. Evaluation of Aggregates for Potential Alkali-Aggregate Reactivity: a) To carry out petrographic analysis and accelerated Mortar bar Test on aggregate samples (1N NaOH at 80 deg. Centigrade for 14 days as per ASTM 1260, or the method established/ developed by CSMRS for 22days test). b) If rock type is limestone, alkali carbonate reactivity test shall also be carried out wherein the parameters shall be reported in conjunction with the petrographic analysis. Additionally, X-Ray diffraction test (XRD) shall be carried out to determine critical clay mineral in the rock for preliminary conclusions. For limestone aggregates to be used in dynamic foundations like TG, BFP, Fans, mills and crushers, repeated temperature cycle test shall also be carried out, to determine residual expansion of aggregate for concrete. c) To prepare a report based on test results of a) and b) above and to advise regarding suitability of aggregates to be used and further testing required if any.		
5.0.0	LABORATORY AND FIELD TESTING		
5.1.0	The field laboratory for QA and QC activities shall be constructed and set-up by the contractor in line with the indicative field QA&QC laboratory set-up enclosed at Annexure-IV. The Laboratory building shall be constructed and installed with the adequate facilities to meet the requirement of envisaged test setup. Temperature and humidity controls shall be available wherever necessary during testing of samples. The		
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	quality plan shall identify the testing equipments/ instrument, which the contractor shall deploy and equip the field quality laboratory for meeting the field quality plan requirements. The contractor shall furnish a comprehensive list of testing equipments/ instrument required to meet the planned/scheduled tests for the execution of works for OWNER acceptance/ approval. The contractor shall mobilize the requisite laboratory equipment and QA&QC manpower at least 15 days prior to the planned test activity as per the schedule of tests.		
5.2.0	All equipments and instruments in the field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the OWNER. The calibration certificates shall specify the fitness of the equipments and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipments and instruments by an NABL / NPL accredited agency and the calibration report shall be submitted to OWNER.		
5.3.0	The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute. This includes selected IITs, NCB, CSMRS, reputed government / autonomous laboratories / organizations, NITs and other reputed testing laboratories. The test samples for such test shall be jointly selected and sealed by the engineer and thereafter these shall be sent to the concerned laboratory through the covering letter signed by OWNER engineer. The test report along with the recommendations shall be obtained from the laboratories without delay and submitted to OWNER.		
5.4.0	Based on the schedule of work agreed with the engineer-in-charge and the approved FQP, the contractor shall prepare a schedule of tests and submit them to the engineer-in-charge and organize to carry out the tests as scheduled / agreed.		
6.0.0	PURCHASE AND SERVICE		
6.1.0	The major items/ equipments/ components to be manufactured in the shop of the contractor i.e. in-house items and those procured from sub-vendors / sub-manufacturer / sub-contractors i.e. bought out items (BOIs) shall be listed out by the contractor in their bid proposal.		
6.2.0	The list of manufacturers/ sub-vendors for all the BOIs envisaged in contract including shall be included in the bid proposal by the contractor which shall be discussed / reviewed by the OWNER during post bid discussions and the list of proposed manufacturers / sub-vendors for each of the BOIs shall be agreed/ approved. If any item is left out or gets included during detailed engineering, the contractor shall propose the manufacturer's / sub-vendor's details for review / approval of OWNER, prior to initiating the procurement of such materials.		
6.3.0	Where the manufacturers are placed in details required ("DR") category, the details of the manufacturers / sub-vendors placed in the "DR" category shall be submitted to the OWNER for approval in the prescribed OWNER format within the period agreed at the time of post bid discussions. The contractor's proposal shall include vendor's site facilities, expertise, facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-Contractors proposed. The formats for furnishing		
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	above details shall be given to the Contractor at post bid discussion stage. Monthly progress reports on sub-contractor detail submission / approval shall be furnished. Such manufacturers / sub-vendors approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.		
6.4.0	To facilitate advance planning of material testing/ approval of bought out items, well before the start of activity as per L-2 network, representative samples shall be procured by the contractor from approved sub-vendors and submitted to the engineer for his approval before bulk procurement at least two months prior to start of works. In case of manufacturers test certificate (MTC) is submitted for acceptance, it shall be clearly traceable and correlated with the consignment received at site. MTC of all bought out items shall essentially contain all the test parameters / characteristics specified in the technical specifications / standards / codes. In case the manufacturer's test certificate does not mention these details, sample from each lot shall be tested for these properties at the third party lab acceptable to OWNER. Approval of material / sample by the engineer shall not relieve the contractor of his responsibility, for their conformance to the specification, as well as the requisite performance and quality of material.		
6.5.0	Monthly progress reports on sub-contractor detail submission / approval shall be furnished as per Engineering Co-ordination Procedure. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract. Sub-vendor whose details are not submitted within the agreed cut-off date, shall be deemed to be withdrawn by the contractor.		
6.6.0	Structural steel and Reinforcement steel supply if in the scope of the contractor shall be procured from Main Steel Producers enlisted by OWNER Consultant from time to time. Currently, Main Steel Producers enlisted by OWNER Consultant are SAIL, JSW Steel Ltd, Jindal Steel & Power, Tata steel Ltd. (for Reinforcement steel/TMT bars), RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Essar Steel India Ltd. (for Flat products/ Steel Plates), Electrosteel steel Ltd. (for Reinforcement steel/TMT bars) and Monnet Ispat and Energy Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequent, if any new Main Steel Producer/s are enlisted, they may also be considered for procurement during execution of the contract if proposed by the Contractor."		
7.0.0	MANUFACTURING QUALITY PLAN AND FIELD QUALITY PLAN		
7.1.0	All materials / components and equipment covered under the scope of work, shall be procured by the contractor for the purpose of the contract, after obtaining the written approval of the OWNER, which are to be manufactured at shop/ factory of the vendor/sub vendor shall be covered under a comprehensive quality assurance programme. The contractor's purchase specifications and inquiries shall call for Manufacturing Quality Plans (MQP) to be submitted by the sub-contractor/ sub-supplier/ sub-vendor. The MQP called for from the sub-contractor shall detail out for all the components and equipment, various tests / inspection, to be carried out as per the requirements of this specification and standards mentioned therein, quality practices and procedures followed by contractor's / sub-contractor's / sub-supplier's quality control organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/ performance testing. Such quality plans of the		
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	vendors / sub-vendors shall be submitted to the OWNER for approval in the prescribed format no. QS-01-QAI-P-09/F1-R1 for MQP and such approved quality plans shall form a part of the purchase order / contract between the contractor and sub-contractor. The quality plans shall be submitted on electronic form e.g. CD or E-mail in addition to hard copy, for review and approval of OWNER. After approval the same shall be submitted in compiled form on CD in addition to hard copy.		
7.2.0	The contractor shall furnish copies of the reference documents/ plant standards / acceptance norms/ tests and inspection procedure etc., as referred in quality plans. These quality plans and reference documents/standards etc. will be subject to OWNER approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, OWNER shall identify customer hold points (CHP), i.e. test/ checks which shall be carried out in presence of the OWNER engineer or his authorized representative and beyond which the work shall not proceed without consent of OWNER in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to OWNER along with technical justification for approval and dispositioning.		
7.3.0	Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the OWNER for reference / record by the contractor along with a report of the purchase orders placed so far for the contract.		
7.4.0	Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans (FQP) on the format No. QS-01-QAI-P-09/F2-R1, and obtain approval of OWNER, which shall detail out for all the works, equipments, services, quality practices and procedures etc in line with the requirement of the technical specifications to be followed by the contractor at site. This FQP shall cover for all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site. An Indicative Field Quality Plan for civil works is enclosed at Annexure – V-A (Indicative FQP for civil works) & Annexure – V-B (Indicative FQP for structural steel works).		
7.5.0	Monthly progress reports on MQP / FQP submission / approval shall be furnished by the contractor on the format No. QS-01-QAI-P-02/F1-R0. List of items requiring quality plans and sub-supplier approval shall be finalized with the contractor on the format no. QS-01-QAI-P-01/F3-R1 during the post bid discussions.		
8.0.0	DISPOSITIONING OF NON CONFORMITIES		
8.1.0	The non-conformity for the site works on being detected / noted shall be reported by the contractor in the standard format no. QS-01-FQA-P-08/F1-R0 (Issue 2) of OWNER under the system of dispositioning of non conformity report (NCR) to the engineer. The dispositioning of the NCR relating to equipment, assemblies, materials condition or process during construction / erection shall describe the proposed correction and also include the preventive / corrective action plan for future.		
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9.0.0	QUALITY AUDIT			
9.1.0	OWNER reserves the right to carry out quality audit and quality surveillance of the quality management and control activities, systems and procedures of the contractor or their sub-contractor. The contractor shall provide all necessary assistance to enable the OWNER carry out such audit and surveillance. The contractor shall also take necessary measures, raise NCRs wherever required based on the audit findings / observations.			
10.0.0	QA DOCUMENTATION PACKAGE			
10.1.0	The contractor shall be required to submit the QA documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (✓) mark. Typical contents of QA documentation pertaining to field activities as per approved MQP, FQP and other agreed manuals / procedures, prior to commissioning of individual system shall generally contain the Quality Plan, Material mill test reports, Non-destructive examination results / reports, Heat Treatment Certificate/Record, Non-conformance Reports, CHP, Certificate of Conformance (COC) and MDCC.			
11.0.0	GENERAL QA REQUIREMENTS			
11.1.0	The contractor shall ensure that the works, BOIs and services under the scope of contract whether manufactured or performed within contractor's works or at his sub-contractor's premises or at the OWNER's site or at any other place of work are in accordance with the OWNER technical specification, applicable standards / codes, approved drawings / data sheets / quality plans and BOQ. All the works, BOIs and services shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.			
11.1.1	STORAGE AND HANDLING OF CONSTRUCTION MATERIALS			
	All materials shall be stacked and stored by the Contractor as per IS-4082 and as per the requirements specified in OWNER Technical Specification.			
11.1.2	EXCAVATION AND FILLING WORKS			
	The contractor shall submit a work methodology covering various items of works for all stages of excavation and filling works. This methodology shall broadly include the quantity wise and classification wise identification of source of excavation and filling, suitability tests as per specification requirements, method of stockpiling, transportation, placement, spreading , compaction, equipment, list of protocols, in-situ tests, third party lab test if required, acceptance checks for final clearance. For blasting work at site if required, the contractor shall associate themselves with the reputed specialized blasting agency such as CMRI, NIRM for trials blasts, design blasts, blasting pattern, monitoring of blast during the blasting operations at site. The contractor shall install and operate equipment (such as tri-axial seismograph) for continuous monitoring and control of blast induced vibrations, noise level/ air pressure, dust, silica and noxious gases during all blasting operations in line with the technical specification			
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11.1.3	requirements in association with the specialized blasting agency. The contractor shall submit the un-priced copy of the award on the specialized blasting agencies to OWNER, highlighting the scope of services / work awarded to them by contractor. The services of such specialized blasting agency shall be available through out the period in which the blasting work is undertaken at site. The blasting operation shall remain in charge of a responsible, competent, authorized and experienced supervisor (man-in-charge) and thoroughly acquainted workmen. All blasting work shall be done as per approved blasting scheme/ design/ pattern in line with the technical specification requirements and all statutory laws, rules, regulations, relevant standards pertaining to the acquisition, transport, storage, handling along with use of explosives shall be strictly followed by the contractor. Tolerance for finished surface level shall be within 20 mm of the level shown in the drawing. For an unimportant area, tolerance up to +75mm shall be acceptable at the discretion of the engineer. However, these tolerances shall be applicable for localized areas only. Acceptance criteria shall be a) When only one set of sample is tested, then all individual samples collected and tested should pass without any deviation b) For retest of any sample two additional samples shall be collected and tested, and both should pass without any deviation. c) Where a large number of samples are tested for a particular test then 9 samples out of every 10 consecutive samples tested shall meet the specification requirement.													
	MASONRY AND ALLIED WORKS													
	The execution, finishing, testing and acceptance of masonry related works shall be as per the provisions of technical specifications / relevant practices IS code. Local depressions on account of faulty workmanship, broken / chipped edges shall not be acceptable.													
	All masonry shall be built true and plumb within the tolerances prescribed as below. Care shall be taken to keep the perpends properly aligned. Unless specified otherwise the tolerances in construction of masonry works shall be as below:													
	<table><tr><td>Sl. No.</td><td>Type of Check</td><td>Tolerance</td></tr><tr><td></td><td>Deviation in verticality in total height of any wall of a building</td><td>Shall not exceed ± 12.5mm (more than one storey) ± 6mm per 3m height (within a storey)</td></tr><tr><td></td><td>Deviation from the position shown on the plan of any brickwork</td><td>Shall not exceed 12.5mm (more than one storey)</td></tr><tr><td></td><td>Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment</td><td>Shall not exceed 6mm</td></tr></table>			Sl. No.	Type of Check	Tolerance		Deviation in verticality in total height of any wall of a building	Shall not exceed ± 12.5mm (more than one storey) ± 6mm per 3m height (within a storey)		Deviation from the position shown on the plan of any brickwork	Shall not exceed 12.5mm (more than one storey)		Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment
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		Deviation of bed joint from horizontal in any length, and it	Shall not exceed 6mm (upto 12m) Shall not exceed 12.5mm total (in any length over 12m)
		Deviation from the specified thickness of bed-joints, cross-joints or perpends	Shall not exceed ± 3mm
		Finished plastered surface	Deviation not more than 4 mm when checked with a straight edge of 2 m length placed against the surface
		The average thickness of plaster	Not be less than the specified thickness
		The minimum thickness over any portion of the surface	Not less than the specified thickness by more than 3 mm for plaster thickness above 12mm and 1 mm for ceiling plaster
11.1.4	CONCRETE WORKS For concreting works provisions of technical specifications and IS: 456 shall apply. A detailed methodology for concrete works shall be submitted by the contractor to OWNER for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted. The methodology for concrete works shall broadly contain the suitability of source of aggregates, cement, admixture, water and reinforcement steel, etc. The available concrete mix design recommended from a specialist institute, results of trial mix carried out at site, method / control of batching, mixing, transportation, layer wise placement, compaction, fixing / removal of form work, staging, fixing of water stops at appropriate locations along with specials, expansion joints, contraction joints and construction joints, cover blocks and method of curing, methodology of repair of newly placed hardened concrete, testing and sampling of concrete during production and placement and acceptance checks for final clearance. The equipment, deployment of manpower and machinery shall arranged by the contractor to ensure the continuous rate of placement of specified grade of concrete so as to prevent segregation, bleeding, formation of cold joints, temperature control for concreting in extreme weather conditions and for mass concreting works. Exposed surfaces of concrete shall be kept continuously in a damp or wet condition for at least seven days from the date of placing concrete in case of ordinary Portland cement, not be less than 10 days for concrete exposed to dry and hot weather conditions, at least 10 days or period may be extended to 14 days where mineral admixtures or blended cements are used. Approved curing compounds may be used in lieu of moist curing with the permission of engineer-in-charge.		
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	Reinforcement steel shall conform to relevant IS codes. Lapping / spacing of reinforcement shall be so staggered that under no circumstances more than 50% of bars at any cross section shall be lapped. Corrosion resistance Steel shall be used for the foundations wherever specified in the technical specification. Sample test for 3% of the number of mechanical bars grips subject to a minimum of three, shall be carried out up to the yield strength of reinforcement of bars. Ultrasonic pulse velocities (UPV) test as per IS 13311 Part I, for top deck of T.G. foundation, to ascertain the homogeneity and integrity of concrete. Test cubes @ 150 cum of concrete, subject to minimum of 6 cubes, shall be additionally sampled for being used, for carrying out UPV test on cubes. UPV test shall be carried out by a specialized agency. Test shall be conducted for the water tightness of the liquid retaining structures as per technical specifications, IS 3370 and IS 6494. All the materials, equipments, processes used in pre cast concrete work shall conform to the requirements for the cast-in-situ concrete. If fly ash is used in concrete, source of supply shall be checked for suitability as per IS 3812 (Part-I). Routine tests for retention of particles on 45μ sieve and loss on ignition shall be carried out on each lot of fly ash before its use. The storage of fly ash shall be similar to that of cement. Separate Silo for fly ash shall be provided in the batching plant. Validation of Mix design using fly ash shall be carried out by an approved specialist agency, before start of concrete production. The acceptance criteria of concrete shall be in accordance with clause no.16 of IS 456. However in exceptional circumstances and that too in non-critical areas, the engineer may accept concrete work which is marginally unacceptable as per the criteria laid down in IS 456. For such accepted work, payment shall be made at a reduced rate pro rata to the concrete cube strength obtained, against that stipulated. All records of concreting, reinforcement, testing of materials, as-built dimensions, the details of the rectification, etc, shall be maintained as given below. Four copies of such record in a bound form shall be submitted to owner for their record and future reference. - Testing data / report of aggregates including petrographic examination & potential reactivity of aggregate and repeated temperature cycle tests wherever specified - Mix design details and record of trial mixes carried out at site - Testing records of admixture as per IS-9103 / ASTM C494 including third party test reports. - Approved scheme for concreting - Hourly records of concreting including pour card - Protocol indicating the dimensional tolerance and details of inserts - Records giving the details of rectification giving the location of grouting, the quantity of grout used at each location, type of grout used		
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	h. Bar bending schedule i. Location and details of mechanical anchoring used for reinforcement j. Protocol giving the details of checking of reinforcements before concreting and conformance to the reinforcement details as shown in the construction drawings k. Photographs showing the areas where rectification works have been carried out. Photographs should be taken before and after rectification l. Temperature control record of concrete at the time of placement if applicable m. Details of curing, staging and fixing / removal of formwork, checklist for formwork as per Clause 9.9 and Annexure-C of IS 14687 including all machine foundations n. Batching Plant shall be calibrated regularly at least once in a 3 months. Computerized output shall be taken for each batch of production of concrete. For concreting works of ash pipe pedestals, mixer with weight batcher may be used. o. Dimensions (length, cross sectional dimensions, straightness, squareness, and flatness) and tolerances for pre cast members as per OWNER Technical Specification. Load test on Pre cast members (except pre- cast tiles to be laid in the reservoir) shall be carried out @ 1% up to 1000 nos., @0.5% from more than 1000 nos. precast members of one type. The load test shall be carried out as per the provisions of IS-456 and relevant IS code. <table><tr><th colspan="4">TOLERANCES</th></tr><tr><th colspan="2">Description of Item/ Structural Element</th><th>Max (mm)</th><th>Min (mm)</th></tr><tr><td colspan="4">Cast In Situ Concrete</td></tr><tr><td>1.</td><td>Faces of concrete in foundations and structural members against which back fill is placed</td><td>+25</td><td>-10</td></tr><tr><td>2.</td><td>Eccentricity of footing as percentage of footing width in the direction of placement</td><td colspan="2">2% but limited to 50mm</td></tr><tr><td>3.</td><td>Top surfaces of slabs and of concrete to receive base plates to be grouted</td><td>+5</td><td>-5</td></tr><tr><td>4.</td><td>Alignment of beams, lintels, columns, walls, slabs and similar structural elements</td><td>+5</td><td>-5</td></tr><tr><td>5.</td><td>Cross sectional dimensions of walls, slabs and similar structural elements</td><td>+5</td><td>-5</td></tr><tr><td>6.</td><td>Deviation from specified dimensions of cross-section of columns and beams</td><td>+12</td><td>-6</td></tr><tr><td>7.</td><td>Alignment of holding down bolts without sleeves</td><td>+1.5</td><td>-1.5</td></tr><tr><td>8.</td><td>Alignment of holding down bolts with sleeves</td><td>+5</td><td>-5</td></tr><tr><td>9.</td><td>Level of holding down bolt assemblies</td><td>+10</td><td>-10</td></tr><tr><td>10.</td><td>Embedded Parts (in any direction).</td><td>+5</td><td>-5</td></tr><tr><td>11.</td><td>Level of embedment for equipment support</td><td>+1.5</td><td>0</td></tr><tr><td>12.</td><td>Level of embedment for other embedded parts</td><td>+5</td><td>-5</td></tr><tr><td>13.</td><td>Centers of pockets or holes with greatest lateral dimension not exceeding 150mm</td><td>+10</td><td>-10</td></tr><tr><td>14.</td><td>Variation in steps - Riser - Tread </td><td>+1.5 +3.0</td><td>-1.5 -3.0</td></tr><tr><td colspan="2"></td><td></td><td></td></tr></table>			TOLERANCES				Description of Item/ Structural Element		Max (mm)	Min (mm)	Cast In Situ Concrete				1.	Faces of concrete in foundations and structural members against which back fill is placed	+25	-10	2.	Eccentricity of footing as percentage of footing width in the direction of placement	2% but limited to 50mm		3.	Top surfaces of slabs and of concrete to receive base plates to be grouted	+5	-5	4.	Alignment of beams, lintels, columns, walls, slabs and similar structural elements	+5	-5	5.	Cross sectional dimensions of walls, slabs and similar structural elements	+5	-5	6.	Deviation from specified dimensions of cross-section of columns and beams	+12	-6	7.	Alignment of holding down bolts without sleeves	+1.5	-1.5	8.	Alignment of holding down bolts with sleeves	+5	-5	9.	Level of holding down bolt assemblies	+10	-10	10.	Embedded Parts (in any direction).	+5	-5	11.	Level of embedment for equipment support	+1.5	0	12.	Level of embedment for other embedded parts	+5	-5	13.	Centers of pockets or holes with greatest lateral dimension not exceeding 150mm	+10	-10	14.	Variation in steps - Riser - Tread	+1.5 +3.0	-1.5 -3.0				
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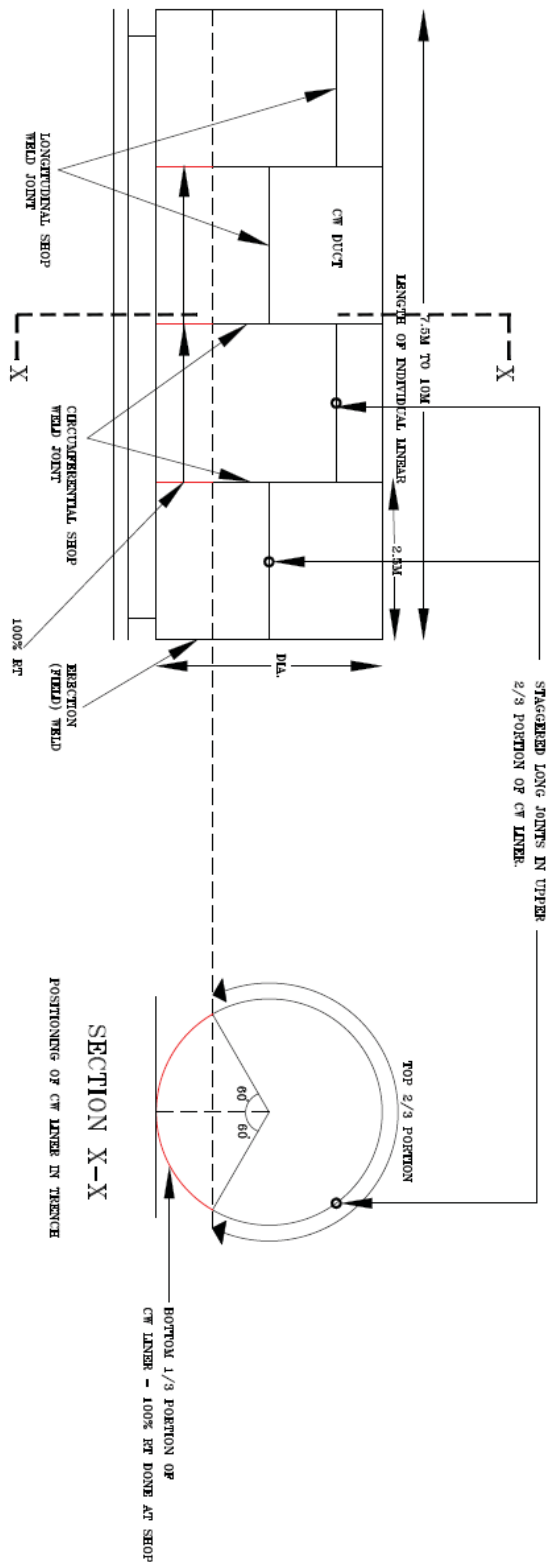
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11.1.5.1	For structural steel works provisions of technical specifications and IS: 800 shall apply. A detailed methodology for structural steel works shall be submitted by the contractor to OWNER for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted.																																																										
11.1.5.2	The contractor shall submit the welding procedures specification (WPS), heat treatment procedures, NDT procedures etc. at least ninety days before scheduled start of erection work at site. All welding and brazing shall be submitted to the OWNER and carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the OWNER.																																																										
11.1.5.3	All brazers, welders and welding operators employed on any part of the contract either in the contractor's / sub-contractor's works or at site or elsewhere shall be qualified as per AWS D1.1/ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the OWNER.																																																										
11.1.5.4	The records of welding procedure qualification and welder qualification test results shall be furnished to the OWNER for approval. However, where required by the OWNER, the tests shall be conducted in presence of OWNER / authorized representative.																																																										
11.1.5.5	No welding shall be carried out on cast iron components for repair. All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.																																																										
11.1.5.6	All Non-destructive examination shall be performed in accordance with written procedures as per International Standards and as mentioned elsewhere in the technical specifications.																																																										
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	specification. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. The records of RT (Films) and UT (inspection records or printed reports if possible) shall be documented and produced to OWNER.																																
11.1.5.7	Low hydrogen electrode (AWS E-7018) for welding of High/Medium tensile steel, for M.S (IS 2062) sections thickness above 20mm shall be used. Preheating and Post weld heat treatment requirements shall be complied as specified in the technical specification / approved WPS.																																
11.1.5.8	The requirements of pre-heating shall be <table><tr><td>Thickness of thickest part at the area of welding / heat affected zone</td><td>Welding using other than low hydrogen welding electrodes IS 2062</td><td>Welding using low hydrogen welding electrodes or submerged arc welding IS 2062</td></tr><tr><td>Upto 20 mm (including)</td><td>None</td><td>None</td></tr><tr><td>Over 20 mm to 40 mm (including)</td><td>Not allowed</td><td>20⁰ C</td></tr><tr><td>Over 40 mm to 63 mm (including)</td><td>Not allowed</td><td>66⁰ C</td></tr><tr><td>Over 63 mm</td><td>Not allowed</td><td>110⁰ C</td></tr></table>			Thickness of thickest part at the area of welding / heat affected zone	Welding using other than low hydrogen welding electrodes IS 2062	Welding using low hydrogen welding electrodes or submerged arc welding IS 2062	Upto 20 mm (including)	None	None	Over 20 mm to 40 mm (including)	Not allowed	20 ⁰ C	Over 40 mm to 63 mm (including)	Not allowed	66 ⁰ C	Over 63 mm	Not allowed	110 ⁰ C															
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11.1.5.9	The following tests / checks shall be carried out for structural steel works <table><tr><td>SL. NO.</td><td>TESTS / CHECKS</td><td>QUANTUM / STANDARD</td></tr><tr><td>1.</td><td>Physical and chemical properties of material if supply in the scope of contractor</td><td>As per relevant codes, review of correlated mill test certificates or check testing in absence of MTC</td></tr><tr><td>2.</td><td>Ultrasonic test on plates above 40mm</td><td>As per ASTM A435</td></tr><tr><td>3.</td><td>Welding procedure & welders qualification test</td><td>AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards</td></tr><tr><td colspan="2">Fillet Weld</td><td></td></tr><tr><td>4.</td><td>Macro-etch examination on production test coupons for main fillet welds</td><td>Minimum one joint per built up beams, columns and crane girder etc.</td></tr><tr><td>5.</td><td>Tension member of crane girder</td><td>Dye penetration test on 25% weld length</td></tr><tr><td>6.</td><td>All other fillet welds</td><td>DPT on 5% of weld length with minimum 300mm at each location</td></tr><tr><td colspan="2">Butt Weld</td><td></td></tr><tr><td>7.</td><td>DPT</td><td>100% after back gouging on all</td></tr></table>			SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD	1.	Physical and chemical properties of material if supply in the scope of contractor	As per relevant codes, review of correlated mill test certificates or check testing in absence of MTC	2.	Ultrasonic test on plates above 40mm	As per ASTM A435	3.	Welding procedure & welders qualification test	AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards	Fillet Weld			4.	Macro-etch examination on production test coupons for main fillet welds	Minimum one joint per built up beams, columns and crane girder etc.	5.	Tension member of crane girder	Dye penetration test on 25% weld length	6.	All other fillet welds	DPT on 5% of weld length with minimum 300mm at each location	Butt Weld			7.	DPT	100% after back gouging on all
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11.1.6	SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
			butt welds except for coal bunker bins 10% after back gouging-For coal bunker bins
	8.	Mechanical testing of production test coupons	Minimum one joint per built up beam, column and crane girder.
	9.	Radiography test on butt welds (In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1. Wherever RT is not feasible UT to be carried out with the approval of the engineer)	100% RT on butt welds of tension flange (bottom flange) of crane girders 10% RT weld length of each welder on butt welds, except for crane girders and coal bunker 5% spot RT on butt welds / at inaccessible locations UT on butt welds- For coal bunker bins
	10.	Ultrasonic testing on full penetration welds (other than butt welds)	100% UT on the web to flange joint of crane girder 10% UT on other full penetration joints
	11.	Control assembly check in shop before erection	1 st and further every 10 th set of identical structure
	12.	Dimensional tolerances during fabrication and erection	as per IS-7215 and IS-12843
	13.	Surface Preparation and Paint thickness	SA 2 1/2 , By elcometer random after each coat, each member
	CW LINER/DUCT The following tests / checks shall be carried out for CW Liner works:		
	SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
	CW Liner Fabricated at Site (Field Shop) and Factory Fabricated CW Liner using Steel Plates with Longitudinal & Circumferential Weld Joints		
	Option-1		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% for pipes above 1200mm diameter
	4.	UT	Not recommended.
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	SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
	5.	RT	5%
	6.	DPT on finished butt welds	10%
	7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher.
	Option-2		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% for pipes above 1200mm diameter
	4.	UT	Not recommended
	5.	RT	- 100 % RT on circumferential joints in the bottom 1/3 portion of CW liner for weld length as per Fig 1 - 5% RT on top 2/3 portion of circumferential joints and - 5% RT on longitudinal joints
	6.	DPT on finished butt welds	10%
	7.	Hydro test	No Hydro test
	Factory fabricated CW liner using H.R. coils with spiral weld joints		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% DPT for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% DPT for pipes above 1200mm diameter
	4.	UT	Not recommended.
	5.	RT	5% RT
	6.	DPT on finished butt welds	10% DPT
	7.	Hydro test	Hydro test at 1.5 times the design pressure or 2 times the working pressure whichever is higher.
	CW Liners erection site test		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% for pipes above 1200mm diameter
	4.	UT	Not recommended.
	5.	RT	5%
	6.	DPT on finished butt welds	10%
	7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher. In exceptional cases where hydraulic test is not possible the same may be substituted with 100%RT
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11.1.7.	SHOP TEST EOT Cranes, Other cranes & Hoist 1.0 HOOKS 1.01 ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT. 1.02 MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST. 2.0 STEEL CASTING 2.01 DPT ON MACHINED SURFACE SHALL BE CARRIED OUT. 3.0 GIRDERS, END CARRIAGE,CRAB, GEAR BOX AND ROPE DRUM 3.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED. 3.02 NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS: a) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT b) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT c) BUTT WELDS IN ROPE DRUM:- 100% RT AND 100% DPT d) FILLET WELDS:- RANDOM 10% DPT 4.0 FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION) 4.01 ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING. 4.02 DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING. 5.0 WIRE RPOE SHALL BE TESTED AS PER RELEVANT STANDARD. 6.0 REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION. 7.0 THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL ETC. AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP. 8.0 ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.		
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	FIG.1 INDIVIDUAL PIECE OF CW LINER - RADIOGRAPHY TEST NOTE : RADIOGRAPHED PORTIONS OF THE JOINTS TO BE SUITABLY COLORED FOR IDENTIFICATION DURING LAYING. 		
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11.1.8	PAINTING WORKS Painting works shall be carried out as per the provisions of technical specifications. A detailed methodology for painting works shall be submitted by the contractor to OWNER for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted. The methodology for painting works shall broadly contain the source of approved brand of paints, blast cleaning as specified, minimum acceptable size of shot used for blasting, application of primer, intermediate coat and final coat, experience of applicator, etc. testing of painting work and acceptance checks for final clearance. For PU coating works if specified, material shall be procured from OWNER approved source and the application of the PU coating shall be carried out by an experienced authorized applicator of the material supplier approved by OWNER. A separate quality plan and methodology for PU coating works shall be submitted by the contractor for approval of OWNER. Based on the approved quality plan, the tests on material and works shall be got conducted at specialist laboratories like IICT Hyderabad, CECRI Karaikudi.			
11.1.9	SHEETING WORKS All bought out items shall be procured from the approved manufacturers and tested as per relevant Codes/ Specification. Raw material of colour coated sheets shall meet the chemical & physical properties as per relevant standards / codes referred in the approved data sheet. It shall be tested for colour match, bare metal thickness, weight of Z/AZ coating, thickness of painting system, reverse impact, T-Bend adhesion, scratch resistance, salt spray test for 1000 Hrs and any other test / properties as specified in the technical specifications. Colour coated sheets shall be marked with video jet printing at the interval not more than 2m bearing manufacturer's name, date & time of manufacturing. Fasteners shall also be tested for 1000 hrs salt spray test as per the requirement of technical specifications. Bonded Mineral Wool Insulation shall meet the requirements of thickness, density, thermal Conductivity, all other tests as per the technical specifications and IS-8183. For sheet installation no gas cut opening shall be allowed at the site, whenever opening is specified these shall be properly cut in the factory and shall be filled with lipping / flashing for true shape / dimension etc. The sheets/ packets shall be stacked neatly clear off the ground at an angle to the ground, over a base pallet to provide drainage. Water / moisture should not be allowed to stagnate on surface, or in between layers. This can damage the coating, and cause corrosion.			
11.1.10	TILE WORKS The contractor shall submit the work methodology which shall include the type, grade and make of materials along with their technical data sheets, details, etc, clearance from E-I-C regarding leak proofness and damp proofness of parent concrete surface, surface preparation, the procedure of application, curing, testing and acceptance. The agencies having adequate experience to execute the acid / alkali resistant lining works shall be engaged for executing the acid / alkali resistant lining works after obtaining the approval from the E-I-C. The execution, finishing, testing and acceptance of tile works shall be as per the provisions of technical specifications. The material for tile works shall be procured from			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 19 OF 23

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	the OWNER approved brand / source. Local depressions on account of faulty workmanship, tiles / natural stones with cracked or broken / chipped edges shall not be acceptable. The tests shall be carried out on acid resistant bricks / tile- water absorption, compressive strength, resistance to acid, flexural strength, dimensions and all other tests as per IS 4860 and IS 4457, bitumastic ready mixed paint as per IS 158, bitumastic as per IS 9510, potassium silicate, resin type and sulphur type mortars as per IS 4832, part I, II and III, surface preparation for painting as per IS 2395, epoxy painting shall be carried for required coating thickness and dry film thickness.			
11.1.11	FIRE PROOF DOORS Fire Proof doors shall be tested for the requirements mentioned in the Technical Specification. The type test of the doors shall be carried out at CBRI Roorkee for minimum 2 hours fire rating and its Fabrication drawing shall also be approved by CBRI, Roorkee. DFT of paint of Fire Proof Doors and its fittings and fixtures as per BOQ shall be checked. The doors shall be finished with suitable fire retardant painting system			
11.1.12	WATER PROOFING The execution, finishing, testing and acceptance of water proofing works shall be as per the provisions of technical specifications. The material for the works shall be procured from the OWNER approved brand / source and the works shall be executed by the authorized applicator of the supplier. Water proofing shall be tested for water tightness by creating a pond of water minimum 25 mm height on area of 6 m x 6 m, for the period of 48 hrs on fully dried elastomeric membrane surfaces. Minimum 5% area of the roof shall be subjected to water tightness test. Such test necessarily be conducted on vulnerable areas like drain channel / drain head. No dampness shall be visible on the underneath side of roof (i.e. ceiling), parapet and well junctions etc. which have been subjected for testing. The above testing shall be carried out prior to application of wearing course.			
11.1.13	PILING WORK (If Applicable) For piling works provisions of technical specifications, approved drawings, BOQs and relevant IS codes / standards shall apply. The piling works shall be executed by the agency meeting the qualifying requirements as specified. A detailed methodology for piling works shall be submitted by the contractor to OWNER for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted. The methodology for piling works shall broadly contain the method of boring, stability of bore hole, termination criteria, tests / checks for termination level, fabrication of cage, cage lowering, concrete batching / mixing, transportation, placing, recording of the time of construction operations, method of conducting initial and routine load tests, testing			
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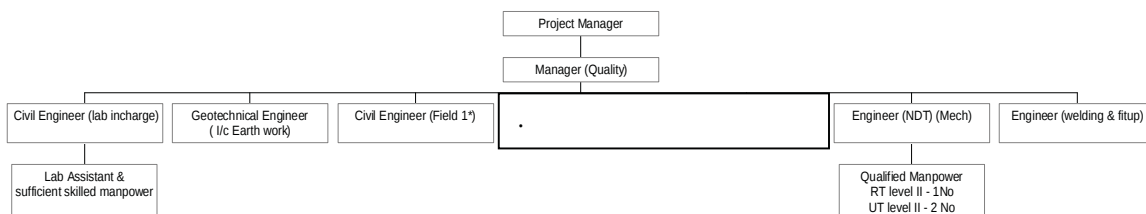
CLAUSE NO.	 Quality Assurance for Civil Works 		
	and sampling of concrete during production and placement and acceptance checks on piles for final clearance. The equipment, deployment of manpower and machinery shall be arranged by the contractor to prevent the collapse of bore hole and to ensure continuous rate of placement of specified grade of concrete. The piling works shall be executed as per the technical specifications, approved drawings, relevant codes / standards, FQP and BOQ. In addition to the requirements of technical specifications, the following shall also be ensured while execution of piling works: a) Time gap between completion of pile boring and start of concreting should be kept to the minimum. However the maximum time gap shall not be more than 6 hours. b) Muck Debris should be removed from the pile bore by air lift technique(by keeping the tremie & air pipe as close as to bottom of pile bore) i.e. after completion of boring, after completion of SPT(whenever applicable), after lowering reinforcement cage, but before start of concreting. c) Density of bentonite slurry shall be checked from the sample taken from the bottom of pile bore(not at 1.0 m above the bottom of the pile bore) d) Minimum two welding sets shall be kept ready to join the two cages of reinforcement by engaging 3 or more welders. This will ensure the lowering of R/F cage in minimum time. e) While lowering the R/F cage into the pile bore, two hooks shall always be used to ensure balanced/symmetrical insertion of cage into the pile bore. f) Concrete cover blocks at the junction of two R/F cage shall be ensured before lowering the second segment. g) Surge concreting of about 1.0 cum shall be ensured at the start of concreting (i.e. in the first pour), by suddenly allowing to fall through the tremie pipe from the funnel. This will help in displacing left out muck/debris in the pile bore (by the impact). h) Continuous feeding of concrete shall be ensured by deploying at least two transit concrete mixers (if required to be deployed) and mixing done through concrete batching plant (if deployed). Cold joints in the pile shall be avoided. i) In a pile group, SPT shall be carried out at termination level in the pile, taken up first. j) Bentonite slurry circulation to be ensured from start of boring to start of concreting. Flushing of bentonite slurry will only ensure maintaining of density of bentonite slurry uniformly and will not allow bentonite jelly to settle at the bottom, whereas air lift technique with bentonite circulation will ensure removal of muck debris from the bottom of pile bore. k) Properties of drilling mud shall be checked prior to commencement of the piling work and thereafter, minimum once per week or as found necessary by the engineer. One sample consisting of 3 specimens shall be tested for the above. l) Low strain pile integrity test on all job piles and test piles shall be conducted as specified in the Technical Specification. This test shall be suitably used to identify the piles for routine tests. High Strain dynamic test shall be done as per the technical specification. The frequency of the test shall be as per the BOQ		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 21 OF 23

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	m) For Working Piles: Minimum one sample consisting of 6 test cubes shall be made for first ten piles. Out of these 3 shall be tested for 7 days cube strength and 3 for 28 days cube strength. Minimum one sample of 6 test cubes for every 25 nos. of piles shall be tested, out of these 3 shall be tested for 7 days cube strength and 3 for 28 days cube strength PILE LOAD TEST Pile load testing shall conform to the requirements of IS-2911 (Part IV) and the technical specification. Initial load tests as specified in the contract documents shall be conducted to assess the safe load carrying capacity of pile before start of work. To verify the load carrying capacity of the working piles, routine load test shall be conducted. Pile load-testing procedure and the test setup / scheme shall be submitted for approval of OWNER. The contractor shall use the test setup having arrangement for anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge for both vertical compression and uplift (tension) Load test (initial) on piles. The cost of reaction system / piles shall deem to be included in the cost of test piles All the gauges and instruments shall be calibrated before the start of the tests on test piles and working piles and the calibration record shall be verified before start of execution of the test.			
11.1.14	WATER SUPPLY, DRAINAGE & SANITATION Material used for sanitary and plumbing fittings and fixtures shall conform to and be tested as per the requirements of relevant IS Codes specified in OWNER technical specification. The obstructions in sewer lines shall be checked by inserting a smooth ball, of diameter 13 mm less than the pipe bore at the high end of the sewer or drain. If absence of any obstructions, such as yarn or mortar projecting through the joints, ball shall roll down the invert of the pipe and emerge at the lower end. The straightness shall be checked by means of a mirror at one end of the line and lamp at the other. If the pipeline is straight, the full circle of the light may be observed. The mirror will also indicate obstruction in the barrel, if the pipeline is not straight. The service pipes shall be slowly and carefully charged with water, allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under test / working condition of pressure and flow, when all draw-off taps are closed. The service pipes shall be checked for satisfactory support and protection from damage, corrosion and frost.			
11.1.15	ARCHITECTURAL & MISC. WORKS Material used for sanitary and plumbing fittings and fixtures, floor finishes and allied work shall conform and tested as per the requirements of relevant IS Codes specified in OWNER technical specification.			
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CLAUSE NO.	एनटीपीसी NTPC Quality Assurance for Civil Works 				
11.1.16	Fabricated item like metal doors, windows, ventilators, louvers, rolling shutters and grills etc. shall be checked for correctness of locations and smoothness of operation and fixtures. All controls and locking devices shall give fault free performance. Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 2.5 mm. Materials used in glass and glazing shall be procured from source approved by OWNER and shall conform to the requirements of the Technical Specification and IS Codes. False ceiling panels shall be best quality material in thickness and properties called for in the specification / schedule of items. Material Test Certificate to be submitted before bulk supply. All bought items covered in the scope of contract shall be procured from sources approved by OWNER and shall conform to the requirements of the technical specifications and referred standards /codes.				
	ROAD WORK Quality Assurance and testing requirements for roadwork shall be as per the MORTH-Specification (Section 900), IRC specifications or CPWD specifications as specified in the technical specifications and BOQ of the contract. The testing and sampling shall include the checks on earth work for embankment and subgrade, sub bases and bases and bituminous constructions. The sampling and testing of concrete pavements shall be as per the respective items of earthwork, subgrade / sub-base, concrete, etc.				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-371		SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 23 OF 23

ANNEXURE-I

QA&QC ORGANISATION SETUP

**NOTE:**

1. The above organization setup is minimum however their deployment shall be as per the agreed deployment schedule. The contractor shall prepare a manpower deployment schedule in line with the finalized work plan and the same shall be submitted to the engineer-in charge for acceptance/ approval.
2. The contractor shall mobilize the QA& QC manpower in line with the finalized manpower deployment schedule and shall ensure their availability well in advance (15 days approx.) of the beginning of the concerned activity/ work.
3. The contractor shall further mobilize required number of skilled & supporting staff and additional resources, if any to meet the work schedule.
4. * For concrete work 2 Nos (one for foundation work & one for superstructure)
5. ** For lines and levels - 1 No.
6. *** For Finishes and cladding work - 1 No

LIST OF SPECIALIST INSTITUTES / ORGANIZATIONS FOR TESTING AND EVALUATION OF BUILDING MATERIALS				
Sl No.	Name of the Institute	Contact Person	Test Facilities	Special Studies / Investigation
1	Indian Institute of Technology Bombay, Powai, Mumbai - 400076	Head, Deptt of Civil Engg, Phone : 022 25722545	Mix design and material properties on selective basis	In situ non destructive testing (UPV) of concrete structures, design of mass concrete, temperature studies, distress assessment
2	Indian Institute of Technology Madras, Chennai- 600 036	Head, Deptt of Civil Engg, Phone: 044 22574266/5255	Selective specialised studies such as design of fly ash concrete and special concrete, non destructive testing (UPV) of structures	
3	Indian Institute of Technology Guwahati -781039	Head, Deptt of Civil Engineering, Phone : 0361 2582401, 258 2442, 258 2440	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, steel reinforcement, petrography, alkali aggregate reactivity, mix design	In situ non destructive testing (UPV) of concrete structures (selective basis), design of mass concrete, studies on properties of fly ash concrete
4	Indian Institute of Technology Kanpur (UP) - 208016	Head, Deptt of Civil Engineering, Phone: 0512 2597346	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, mix design	Non destructive testing (UPV) on concrete structures, structural health assessment
5	Indian Institute of Technology Kharagpur (WB) -721302	Head, Deptt of Civil Engineering, Phone: 03222 283421	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, mix design, petrography	
6	Indian Institute of Technology Delhi, Hauz Khas, New Delhi - 1100 016	Head, Deptt of Civil Engineering, Phone: 01126591191	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, mix design	In situ non destructive testing (UPV) of concrete structures (selective basis)
7	Indian Institute of Technology, Roorkee - 247667	Head, Deptt of Civil Engineering, Phone: 01332 285439, 273560	Testing and evaluation of cement (physical and chemical), aggregates (mechanical), fly ash (physical and chemical), admixtures, water, steel reinforcement, mix design, petrography, alkali aggregate reactivity	Various tests on other building materials such as silica fume, mass concrete, steel, bricks, tiles, doors, ferrocement covers, pipes, bridge bearings, PVC water tanks, etc
8	Indian Institute of Science Bangalore 560012	Head, Deptt of Civil Engineering, IISc Bangalore	Design of roller compacted concrete, radiation shield concrete, high volume fly ash concrete, fire behavior of concrete, micro cracking of concrete, non destructive testing (research & development) activities, behavior of concrete under shrinkage and creep, assessment of fire damaged concrete	IISc basically involved in r&d activities related to civil engineering and may only be contacted in case of specific studies / consultancy.
9	Institute of Technology, Banaras Hindu University (BHU) Varanasi (UP) -221005	Head, Deptt of Civil Engineering, Phone: 0542-2307016	Testing and evaluation of cement (physical properties), aggregates (mechanical properties), admixtures, water, mix design, petrography	

LIST OF SPECIALIST INSTITUTES / ORGANIZATIONS FOR TESTING AND EVALUATION OF BUILDING MATERIALS

Sl No.	Name of the Institute	Contact Person	Test Facilities	Special Studies / Investigation
10	Central Building Research Institute (CBRI), Roorkee - 247667	Head, Structural engineering division, Phone: 01332 283382	Testing and evaluation of cement (physical and chemical), aggregates (mechanical), fly ash (physical and chemical), admixtures, water, mix design, alkali aggregate reactivity	Fire rating of doors, non destructive testing of structures, various tests on other building materials such as bricks, steel, tiles etc
11	Central Soil and Materials Research Station (CSMRS), Near IIT Delhi, Olof Palme Marg, New Delhi - 110016	Joint Director Phone: 011 26962608	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, petrography, alkali aggregate reactivity, mix design	Various tests on other building materials such as steel, geotextiles, geomembrane, soil, instrumentation, monitoring, etc
12	National Council for Cement and Building Materials (NCB), 34 KM Stone, Delhi Mathura Road Ballabgarh(Har)	Head, Center for Construction Development & Research Phone : 0129 2246173	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, petrography, alkali aggregate reactivity, temperature cycle test, XRD, steel reinforcement, mix design	In situ non destructive testing (UPV) of concrete structures and special studies, testing of bricks, paving blocks, steel bars, silica fume, etc
13	National Council for Cement and Building Materials (NCB), NCB Bhawan, Old Bombay Road Hyderabad 500008	General Manager, Phone 040 23000344, 040-23000343	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, petrography, alkali aggregate reactivity, steel reinforcement, mix design	In situ Non destructive testing (UPV) of concrete structures (selective basis)
14	National Test House, Taramani Chennai 600 113	S.O.(Civil) Phone:04422432374, Fax:04422433158	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, steel reinforcement, water, mix design	Various tests on other building materials such as paving blocks, GI pipes, wires, steel plate, flush doors, salt spray test , etc
15	National Test House, Block CP Sector V, Salt Lake city Kolkata-700 091	S.O. (Civil), Phone:033 2367 3870	Testing and evaluation of cement(physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, steel reinforcement, mix design	Various tests on other building materials such as paving blocks, GI pipes, wires, steel plate, flush doors, etc
16	National Test House (NTH), Karla Nehru Nagar, Ghaziabad (UP)	S.O. (Civil), NTH Ghaziabad	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, stel reinforcement	Timber, clay products, water proofing compound, flush doors, laminated sheets, plywood, etc
17	Structural Engineering Research Centre (SERC), Taramani, Chennai 600 113	Head, Department of Material Testing, Phone: 044 22549152, 22541735	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, steel reinforcement water, mix design	In situ Non destructive testing (UPV) of concrete structures (selective basis) and special studies such as cement admixture compatibility, design of special concrete, evaluation of structures

LIST OF SPECIALIST INSTITUTES / ORGANIZATIONS FOR TESTING AND EVALUATION OF BUILDING MATERIALS				
Sl No.	Name of the Institute	Contact Person	Test Facilities	Special Studies / Investigation
18	Vishveswaraiya National Institute of Technology(VNIT), Nagpur (MH) - 440010	Director, VNIT Nagpur, Phone:0712 2223710, 2222828	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, mix design, petrography	In situ non destructive testing (UPV) of concrete structures and soil tests
19	Anna University, Department of Structural Engineering, Chennai - 600 025	Head, Deptt of Civil Engineering	Testing and evaluation of cement (physical and chemical) , aggregates (mechanical properties) , fly ash (physical and chemical) , admixtures, water, mix design	
20	Shriram Institute for Industrial Research, 19 University Road, Delhi 110007	Dr (Mrs) Laxmi Rawat, Asstt Director & Chief Phone:011 27667267	Testing and evaluation of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water, mix design	Various tests on other building materials such as steel, geotextiles, geomembrane, soil, bricks, tiles, etc
21	Spectro Analytical Lab, E-41, Okhla Indl Area, Ph II, New Delhi 110021	Phone: 011 26383048-49 Fax: 40503150, 40503151	Testing of cement (physical and chemical), aggregates (mechanical properties), fly ash (physical and chemical), admixtures, water	Chemical and physical tests on steel reinforcement
22	Motilal Nehru National Institute of Technology (MNIT), Allahabad - 211004	Director, MNIT Allahabad, Phone: 0532 2271305, Fax: 0532 2545341	Testing and evaluation of cement (physical and chemical) , aggregates (mechanical properties), fly ash (physical and chemical), admixtures, steel reinforcement water, mix design	In situ non destructive testing (UPV) of concrete structures.
23	Govt Engineering College, Jalpaiguri (WB) - 735102	Head Deptt of Civil Engg, Fax: 03561256143	Testing and evaluation of cement (physical), aggregates (mechanical properties), water, mix design	
24	College of Engineering Pune - 411005	Head Deptt of Civil Engg, Phone No : 02025507067 , Fax : 02025507299	Testing and evaluation of cement (Physical & Chemical properties), fly ash (Physical & Chemical properties), aggregates (Mechanical properties except alkali aggregate reactivity & Petrography), water, admixtures and mix design	
25	Maulana Azad National Institute of Technology, Bhopal (MP)	Head Deptt of Civil Engg, Phone No : 07554051390	Testing and evaluation of cement (physical), aggregates (mechanical properties),water, mix design	In situ non destructive testing (UPV) of concrete structures and soil tests.
26	National Institute of Technology, Rourkela (Odisha)	Head Deptt of Civil Engg, Phone No : 06612462300	Testing and evaluation of cement (physical), aggregates (mechanical properties), mix design,	In situ non destructive testing (UPV) of concrete structures and soil tests. Test on steel reinforcement, bricks and bitumen

ANNEXURE - III**Format of Request Letter for Evaluation of Materials**

Ref: _____

Date: _____

To,

Sub.: Evaluation of materials and concrete mix design

Dear Sir,

We have awarded the work of on M/s vide our LOA No.dated.....for execution of Civil Works. Based on provisions of contract, M/s are expected to get the following tests/ evaluation done through your laboratory and accordingly the tests have been described below.

M/s have been advised to deposit the requisite evaluation/ testing charges and to deliver the test samples of quantities, specified below.

1. Evaluation of Cement:

- a) To carry out different physical tests on cement samples i.e. Blaine's fineness, initial and final setting time, soundness and compressive strength at 3, 7 and 28 days as per IS: 4031 and drying shrinkage and specific gravity in case of PPC.
- b) To carry out chemical analysis of the cement samples as per IS: 4032, including the total alkali content of the cement (Na_2O equivalent).
- c) To advise the suitability of cement based on the test results of a) and b) above.

2. Evaluation of Aggregates:

- a) To carry out different tests on coarse aggregate sample i.e. specific gravity, water absorption, sieve analysis, deleterious material; soundness, crushing value, impact value, abrasion value, elongation index and flakiness index, as per IS: 2386.
- b) To carry out different tests on fine aggregate sample i.e. specific gravity, water absorption, sieve analysis soundness, deleterious material, silt content, clay content and organic impurities as per IS: 2386 and mica content.
- c) To prepare evaluation report based on test results of a) and b) above and to advise regarding suitability of fine and coarse aggregates to be used with the cement of 1) above.

3. Evaluation of Aggregates for Potential Alkali-Aggregate Reactivity:

- a) To carry out petrographic analysis and accelerated Mortar bar Test on aggregate samples (1N NaOH at 80 deg. Centigrade for 14 days as per ASTM 1260, or the method established/ developed by CSMRS for 22days test).
- b) If rock type is limestone, X-Ray diffraction test (XRD) shall be carried out to determine clay mineral in the rock for preliminary conclusions and to carry out repeated temperature cycle test to determine residual expansion of aggregate for concrete to be used in dynamic foundations like TG, Fans, mills, crushers etc. Additionally, Alkali carbonate reactivity test shall be carried out as per ASTM C 1105 wherein the parameters shall be reported in conjunction with the petrographic analysis.



- c) To prepare a report based on test results of a) and b) above and to advise regarding suitability of aggregates to be used with the cement of 1) above and further testing required if any.

4. Evaluation of Flyash Sample:

- a) To carry out various physical and chemical tests on fly ash sample i.e. Blaine's fineness, lime reactivity, specific gravity, loss on ignition and other chemical tests as per IS: 3812, conforming to grade-I.
- b) To advise the suitability of fly ash sample based on the test results of a) above.

5. Evaluation of water: To carry out various physical and chemical tests as per IS:456 and IS:3025.

6. Evaluation of admixtures: To carry out various physical and chemical tests as per IS:9103.

Note: Test certificate shall be obtained from the supplier to compare the values given in Table 2 of IS:9103 i.e. uniformity requirements.

7. Concrete Mix Design: Based on the provisions of technical specification, the Following may be specified by site CCD/FQA **

- a) For RCC Work
- Grade of concrete
 - Slump required, mm:
 - Cement- Type and grade
 - Max Size of Aggregates, mm
 - Exposure conditions
 - Maximum water-cement ratio
 - Minimum cement content
 - Plasticizer/ admixture to be used or not (If yes, specify the brand/ type/batch no. of plasticizer)
 - Fly ash to be used or not (If yes, indicate % of fly ash to be used)
- b) For PCC work: Same as i) to ix) of a) above
- c) For piling work(if required): Same as i) to ix) of a) above

8. Details of material sampled: In order to facilitate the above mentioned tests, specified quantities of samples have been collected and sealed jointly (by OWNER -FQA and contractors' representative) is being sent for testing. The impression of seal has also been punched below.

a) Quantity of material required for each mix-design:

Sl. No.	Material Description	Quantity Required
i)	Cement	2bags (sealed in double polythene bags)
ii)	Coarse Aggregates	100Kg of each fraction as explained below : e.g.; If Maximum size of aggregates (MSA) is 20mm, then 100 Kg each of 20-10mm and 10mm down are required. If MSA is 40mm then 100Kg each of 40-20mm, 20-10mm and 10mm down are required.
iii)	Fine Aggregates	200Kg

iv)	Chemical Admixtures	2 Litres
v)	Water	100 Litres
vi)	Fly ash (If decided to be used)	100Kg

b) Quantity of material required for Alkali-Aggregate reactivity

Sl. No.	Material Description	Quantity Required
i)	Coarse aggregate	
a)	80-40mm	60Kg
b)	40-20mm	60Kg
c)	20-10mm	60Kg
d)	<10mm	60Kg
ii)	Fine aggregates	60Kg
iii)	Cement	2 samples (1 bag each), contemplated for use in construction.

c) Impression/ Punch Mark of seal:

You are requested to kindly forward us the test reports along with the recommendations regarding the suitability of materials to us at the earliest.

Thanking you,

Yours faithfully,

Name:

Contact Number:

Email ID:

(FQA Representative of OWNER)

Note:

- Based on provisions of technical specification, the testing charges for all the above mentioned tests shall be borne by the contractor.
 - The content of the letter is for guidance only, and if required may be suitably modified to suit the specific requirements of the package in consultation with QA-Civil.
- ** This line may be deleted in the letter sent to the institute.

Quality Assurance for Civil Works

ANNEXURE - IV

TYPICAL QA/QC LAB EQUIPMENT

Project:

Package:

Sl. No.	Equipment	Nos.
1	Vicat Apparatus with deskpot	2
2	Le Chatelier flask & Mould	2 each
3	Automatic/Manual concrete & Mortar Mixer	1 set each
4	Cube Moulds for cement testing	12
5	Vibration Machine	1
6	Length comparator	2
7	Shrinkage Bar mould	2
8	Automatic Sieve shaker	1
9	IS Sieves for coarse & fine aggregate	1 set for each
10	IS Sieves for coarse aggregate for Road	1 set
11	Proctor testing equipment	2 sets + 18 cores
12	Slump testing equipment	6 sets
13	Oven	2
14	Physical balance	1
15	Rapid moisture meter	2
16	Thermometer	4
17	Burret	2
18	Measuring cylinders	9
19	Measuring flasks	3
20	Compression testing machine	2 sets of 2000 kN capacity each
21	Cube moulds	30
22	Electronic balance	2 (12 kg capacity), (200 mg capacity)
23	pH balance	As per requirement
24	Radiographic facilities	As per requirement, Party should deploy BARC approved agency for carrying out RT
25	Mechanical weighing machine	1 (100 kg capacity)
26	Ultrasonic testing machine	As per requirement
27	D.P. Test kit	10
28	Vernier 300 mm, 600 mm	2
29	Micrometer (0.25 mm) out side (25.00)	2
30	Radiography film viewer	2
31	Inside Micrometer 25-750 dia	2
32	Digital elcometer for paint thickness	2
33	Baking oven for electrode	3
34	Portable ovens	2
35	Rebar detector to locate the reinforcement before core cutting operation	1
36	Concrete coring machine (55mm, 60mm upto 150 mm dia core bit)	1
37	Rebound hammer	1
38	Ultrasonic pulse velocity tester	May be arranged from specialist laboratory.

Quality Assurance for Civil Works

39	Curing tank	1 set
40	Flakiness and elongation index test gauges	2 each
41	Atterberg Limits set-up (Liquid Limit and Plastic Limit) and Shrinkage Limit Apparatus with mercury	1 set each
42	Impact testing machine	1 set
43	Pycnometer	2 set
44	Crushing value apparatus	1 set
45	Los angeles Abrasion Testing Machine	1 set
46	Free swell Index Apparatus	1 set
47	Bitumen Extractor Machine	1 set

Note:

1. The equipments listed above are indicative and required to be mobilized as minimum requirement. Additional equipment if any, required for successful completion of work shall be provided /arranged by the contractor.
2. All test reports/ inspection reports have to be computerized and maintained on LAN with an access to the owner
3. Computers - 2 Nos shall be deployed with Windows operating system and connected to the OWNER server
4. Based on the schedule (L2/L3 Network), Quality control & Quality Assurance work plan shall be finalized by the contractor and the same shall be submitted to the engineer-in-charge for acceptance/approval. The Finalized work plan shall be maintained on the computer to be accessed by the owner for database and day to day monitoring.

Annexure- V A												
INDICATIVE FIELD QUALITY PLAN												
SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK		1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package		Annexure- V A		
Sl. No		Contract No.		REV. NO. : DATE : PAGE :		Type of Check		Quantum Of check		Remarks		
12		1		3		Class of check 4582		Type of Check SR		Once prior to start of work		
1		GENERAL REQUIREMENTS										
A		Setting up of Field QA&QC laboratory		As agreed / required		Physical		Once prior to start of work		Tech Specs and Const. Drawings SR ✓		
B		Availability of requisite laboratory set up and equipment in good working condition well before commencement of concerned activity		As agreed / required		Physical		Once prior to start of work and thereof monthly		Tech Specs and Const. Drawings SR ✓		
C		Submission of QA & QC manpower deployment schedule based on agreed L-2 network .		-Aphysical				Once prior to start of work		Tech Specs and Const. Drawings ✓		
D		Availability of QA& QC manpower based on deployment schedule .		-Aphysical				Once prior to start of work and thereof monthly		Tech Specs and Const. Drawings SR ✓		
E		Sampling for testing of building materials, concrete admixture, concrete mix design etc.		As agreed / required		Physical		Once per each source SR/TR		Tech Specs and Const. Drawings ✓ Test report to be submitted to NTPC.		
F		Submission of schedule of tests to be done monthly / quarterly and maintenance of the same on a computer connected to LAN of OWNER for monitoring		-Aphysical				Once prior to start of work and thereof monthly		Tech Specs and Const. Drawings SR ✓		
G		Stacking and storage of construction materials and components at site		As per IS:4082		Physical		Random SR		Tech Specs and Const. Drawings and IS: 4082 ✓		
H		All boughtout items to be procured from the approved vendor and on approval of Quality plans by OWNER as per inspection Category		-B		Verification of TC and/or Testing		100%SR/LB		OWNER Tech. Spec. /BOQ ✓ The TC submitted should bear proper identification or correlation with the batch of material supplied and same shall be brought out in the challan/ consignment note .		
I		Submission of list of Boughtout items and their vendor for each of the boughtout item identified for approval within the period agreed in LOA.		-Aphysical		One time SR/LB				OWNER Tech. Spec. /BOQ To be submitted to CQA for approval with a copy to site .		
2		EXCAVATION AND FILLING IN FOUNDATION WORKS										
2.1		Excavations-										
2.2		Nature, type of soil/rock before and during excavations		As agreed / required		By visual		Random in each shift SR		Tech Specs and Const. Drawings		
2.3		Initial ground level before start of excavations		As agreed / required		By measurement		100%SR		Tech Specs and Const. Drawings ✓		
2.4		Final shape and Dimensions of excavations.		As agreed / required		By measurement		100%SR		Tech Specs and Const. Drawings		
2.5		Final excavation levels		As agreed / required		By measurement		100%SR		Tech Specs and Const. Drawings ✓		
2.6		Side slope of final excavation		As agreed / required		By measurement		Random in each shift SR		Tech Specs and Const. Drawings		

INDICATIVE FIELD QUALITY PLAN										Annexure- V A	
SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK		Q.P. NO. : REV. NO. : DATE : PAGE :		1.PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	
Sl. No	Contractor's Name and Address	Receipt, Storage, Explosive	Execution of Blasting Operation	Submission of Blasting report to EICAs	Excavation in Hard Rock (Blasting Prohibited)	As agreed / required	BPhysical	Random in each shift	IS-4081, Tech Specs and Const. Drawings	Tech Specs and Const. Drawings	As per approved drawing/ scheme, Tech Specs and Const. Drawings
12		3									
i		As agreed / required	BPhysical	Random in each week	SR				Indian Explosive Act 1940/all statutory norms, Tech Specs and Const. Drawings		
ii		As agreed / required	BPhysical	Random in each shift	SR				IS-4081, Tech Specs and Const. Drawings		
iii		As agreed / required	CPhysical	Each blast					Tech Specs and Const. Drawings		
2.7		As agreed / required	BPhysical	100%	SR				As per approved drawing/ scheme, Tech Specs and Const. Drawings		
Fill/ Backfill -											
2.8											
i		Grain size analysis	Set of Sieves, Hydrometer etc.	BPhysical	Once per each type of source or change of source				IS:2720 (Pl.IV), Tech Specs and Const. Drawings		
ii		Liquid & plastic limit	Mechanical liquid limit device, grooving tools, Evaporating Disc, Spatula, Paletre knives, Balance oven containers, etc.	BPhysical	Once per each type of source or change of source				IS:2720 (Pl.IV) , Tech Specs and Const. Drawings		
iii		Shrinkage limit	As per IS:2720	BPhysical	Once per each type of source or change of source				IS:2720 (Pl.IV), Tech Specs and Const. Drawings		
iv		Free Swell Index	Measuring cylinders, etc.	BPhysical	Once per each type of source or change of source				IS:2720 (Pl.XI), Tech Specs and Const. Drawings		
v. Chemical Analysis											
a		Organic Matter	Over chemical balance, volumetric flasks, burettes, pipettes, conical flasks, set of sieves, measuring cylinders etc.	BPhysical	Once per each type of source or change of source				IS:2720 Pt.XXII, Tech Specs and Const. Drawings		
2.9 Standard proctor Test		Optimum moisture content and max. dry density before fill	As per IS:2720, Proctor needle apparatus etc.	APhysical	One in every 10000 cum for each type and source of fill materials				IS 2720 (Pl.VII), Tech Specs and Const. Drawings		
2.10 Moisture content		Moisture content of fill before compaction	As per IS:2720, balance, oven etc.	APhysical	One in every 10000 cum for each type and source of fill materials				IS 2720 (Pl.II), Tech Specs and Const. Drawings		

Annexure- V A											
INDICATIVE FIELD QUALITY PLAN											
SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK		OP NO. : REV. NO. : DATE :		1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	
Sl. No Characteristic and Requirement		SUB-SYSTEM : GEOTECH INV, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		PAGE :		Type of Check		Acceptance Norms		Format of Record	
Sl. No Characteristic and Requirement		SUB-SYSTEM : GEOTECH INV, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		PAGE :		Type of Check		Acceptance Norms		Format of Record	
12	Degree Of Compaction Of Fill / Backfill	3		Class of check	456789D-10	Quantum Of check	Remarks	Reference Document			
2.11	Dry density by core cutter method ---- OR ---- Dry density in place by sand displacement method		As per IS: 2720/compaction test (core cutter), balance etc.	APhysical		i) For foundation fill/backfill one for every 10 foundations for each compacted layer. ii) For area filling, one every 10000 SQM area for each compacted layer.	IS 2720 (Pt. XXIX), Tech Specs and Const. Drawings	SR/TR	✓		
ii	Relative density (Density Index)		As per IS: 2720, balance oven etc.	APhysical	----do---- (I	) & (ii) above	IS 2720 (Pt. XIV), Tech Specs and Const. Drawings	SR/TR	✓		
iii	Dry Density by proctor needle penetration		As per IS: 2720, proctor needle apparatus etc.	BPhysical		Random checks to be carried out for each compacted layer	Tech Specs and Const. Drawings	SR/TR	✓		
iv	Compaction using Rock boulders & construction debris (if applicable)		As agreed / required	APhysical		i) For foundation fill/backfill one for every 10 foundations for each compacted layer. ii) For area filling, one every 10000 SQM area for each compacted layer.	Tech Specs and Const. Drawings	SR/TR	✓	Where rock boulders (broken into the pieces not more than 200 mm size), construction debris have been used for filling, it shall be compacted to minimum of 85% of original stack of material after filling the interstices with the selected excavated material.	
3.0 MATERIALS											
3.1 CEMENT											
	Releasing of cement as per IS: 4031A		Testing at Random					As per relevant IS Codes	Test Report	✓	Each consignment of cement shall be duly correlated with manufacturers TC in case the cement is supplied by the contractor one sample from each lot shall be tested for setting time and compressive strength . Acceptance norms shall be as per relevant IS. If cement is stored more than 90 days in godown of contractor same shall be retested for comp. Strength & setting time.
3.2 Coarse Aggregate								IS : 456/IS : 383/Tech Spec	SR/LB	✓	during monsoon when this has to be done every day before start of concreting
ii	Specific gravity, water absorption	IS: 2386A Physical				Once for each source & for every change of source	IS: 2386 Part-III, IS: 383/Tech Spec	IS 456, IS: 383/Tech Spec	SR/LB/ Test Report	✓	
iii	Sieve analysis, flakiness index, elongation index.	IS: 2386B Physical				One per 100 cum., or part thereof	IS: 2386 Part-I, IS: 383/Tech Spec	IS 383/Tech Spec	SR/LB	✓	
iv	Deleterious materials (coarse, fine, clay lumps, material finer than 75 micron sieve, soft fragment, shale)	IS: 2386A Physical				Once per source/ on every change of source	IS: 2386 Part-II, IS: 383/Tech Spec	IS 383/Tech Spec	SR/LB/ Test Report	✓	
v	Soundness	IS: 2386A Physical	do-				IS: 2386 Part-V, IS: 383		SR/LB/ Test Report	✓	
vi	Alkali aggregate reactivity	APhysical	do-				IS: 2386 (Part-VII), IS: 383 /Tech Spec/ASTM C-1260 / ASTM 1293		SR/LB/ Test Report	✓	The aggregate type (deleterious/innocuous result should be supported by petrographic examination)
vii	Petrographic examination	IS: 2386 Pt VII/ A					IS: 2386 Part-VIII, IS: 383 /Tech Spec		SR/LB/ Test Report	✓	
viii	Crushing value and abrasion value	IS: 2386A Physical	do-				IS: 383, IS: 2386 Part IV/Tech Spec		SR/LB/ Test Report	✓	

INDICATIVE FIELD QUALITY PLAN										Annexure- V		
SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INVI, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.			1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package			
Sl. No	Contract Item	Class of check	Type of Check	Quantum Of check	Remarks	Acceptance Norms	Format of Record					
12	Aggregate	3	456:2386									
i		Moisture content, water absorption balance oven etc. BPhysical			To be done every day before start of work	IS: 2386 Part-III IS:383	SRLB/ TR	✓				
ii		Deleterious materials (coal&lignite, clay lumps, material finer than 75micron sieve, soft fragment, shale)	IS:2386 APhysical		Once per source& for on every change of source	IS: 2386 Part-II, IS:383	SRLB/ TR	✓				
iii		Silt content	As agreed/required		One per 100 cum., or part thereof	CPWD Tech Spec/IS 23 86/IS 456/IS 383	SRLB/ TR	✓				
iv		Altogether test similar to coarse aggregates as mentioned above.	BPhysical			IS-2386, IS-383	SRLB/ TR	✓	except test for flakiness index, elongation index, abrasion value, impact value			
3.4	Water											
i		Complete Testing as per IS:456-2000	A Testing		Once for each source and then after yearly and on every Seasonal change in case of water collected from open well.	IS:456-2000	SRLB/ TR	✓				
3.5	CONCRETE											
i		4 Trial mixes to ascertain the workability and cube strength	After receiving the recommended mix design from specialist agency.		Ofs for each mix proportion	OWNER Tech specification	SRLB	✓				
ii		Crushing strength (works Tests cubes)	IS:516 APhysical		One set of 6 cubes per 50 Cum or part thereof for each grade of concrete per shift whichever is earlier.	IS:516, IS:456, OWNER Tech. Spec.	SRLB/ Test Report	✓	Min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength.			
iii		Workability - slump test	IS:11998 BPhysical		At the time of concrete pouring at site every two hrs	IS:456/OWNER Tech. Spec.	SRLB/ TR	✓				
iv		Water content	BPhysical			As per approved design mix.		✓	At batching plant			
3.5.1	Admixtures for Concrete				OWNER Approved source and review of MTC/ test reports	Designed mix and IS:9103	Test Report	✓				
3.6	Concrete conveying, placing & compaction											
i		Calibration of Batching Plant	batcher should comply with requirement of IS 4926/IS-4925		To be calibrated at the time of starting and subsequently once in three months, and shall conform to IS:4925	Review of calibration chart/ Certificate/IS 4926	Calibration Certificate	✓	Batching Plant shall be calibrated regularly at least once in a 3 months in-house. The weights for batching plant calibration to be calibrated once in year by NPL/NAABL accredited lab./Weights & Measures Dept.			
ii		Arrangement for transportation & placement of concrete.	As required	CVisual100%		Before clearance for concreting	Inspection Report	✓				
iii		Handling and Transportation of concrete	required	BPhysical100%		As per construction/erection methodology (to be approved one week prior to start of work)						
iv		Placement of concrete	Visual100%	SR		As per construction/erection methodology and tech.specs / No segregation		✓				
v		Temperature Control of Concrete for top deck of TG Foundations.	Thermometer	BPhysical100%		Temperature as per technical specification		✓				

		SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN										Annexure- V A	
			ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INVI, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	QP NO. : REV. NO. : DATE : PAGE :	1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package						
Sl. No	Contract No.	Contract Name	Class of check	Type of Check	Quantum Of check	Remarks	Acceptance Norms	Format of Record						
12			45678910	SR	3		IS:456							
vi			Compacting As required	BPhysical	AI Random	SR	Period of curing as per IS 456 (use gunny bags / curing compound)							
vii			Curing As required	BPhysical	AI Random	SR	As per Technical Specification							
3.7 TEST / CHECK ON RCC STRUCTURE IN HARDENED CONDITIONS														
i			Visual inspection of concrete surface of all dynamic foundations just after removal of shuttering	As required	A Visual	100% SR	As per Technical Specification							
ii			Embedment of sensors in concrete shall be checked for quality using hammer for all dynamic foundations	Hammer	B Physical	100% SR	As per Technical Specification		No hollow sound					
iii			Ultrasonic test on top deck of TG foundation & Other foundations as per technical Specification	IS:13311	A Physical		IS:13311	Test report						
iv			Core Test IS:516	A Physical		As required by OWNER Engineer.	As per IS:456, IS 516	SR/LB/ Test Report	Compressive strength based on core test is required to be carried out only if in case of doubt regarding the grade of concrete used, either due to poor workmanship or based on the results of cube strength test as per 3.5 ii) above.					
v			Rebound Hammer test IS:13311	A physical		as required by the OWNER engineer	As per relevant / tech. Specification.	SR/LB	This test may be carried out to assess the strength of concrete in case of non-critical and lightly loaded structures as the discretions of EIC					
vi			Dimensional check on finished structures & Dimensional tolerances	As required	B Measurement	Approved	As per IS:456/ tech. Specification.							
vii			Water Tightness Test on liquid retaining structure / tanks	As required	A Test	100% SR/LB	IS:3370/ Tech. Specification							

SUPPLIERS NAME AND ADDRESS:			INDICATIVE FIELD QUALITY PLAN					Annexure- V			
Sl. No	Contractor's Logo and Name	ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INV, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	QP NO. : REV. NO. : DATE : PAGE :	1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Acceptance Norms	Format of Record	To be procured from OWNER approved source		
			Type of Check	Quantum Of check	Remarks						
12			456789D-10								
3.8REINFORCEMENT STEEL			3								
i		Physical and Chemical Properties for each lot	As required/ agreed	Review of MTC/ test reports	Each batch of delivery	IS : 1786, IS:432, IS:1566, Tech Specs and Const. Drawings			✓		
ii		Freedom from cracks, surface flaws, Lamination & excessive rust.	As agreed / required	Visual	Random in each shift	IS: 1852, IS:432, IS:1786, Tech Specs and Const. Drawings			To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.		
3.9 PLACEMENT OF REINFORCEMENT STEEL						IS:456, approved drawing and OWNER					
i		Bar bendings scheduled with necessary lap, Spacers & Chairs	As agreed / required	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings IS:2502			✓		
ii		Bending of bars, cutting tolerance	As agreed / required	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS:2502			✓		
iii		Acceptance-Cover spacing of bars, spaces and chairs after the reinforcement cage is in the formwork	As agreed / required	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings			✓		
3.10 STAGING AND FORMS											
i		Materials and accessories	As agreed / required	Visual	Once before start of work	As per relevant IS, Tech Specs and Const. Drawings					
ii		Soundness of staging, shuttering and scaffolding including application of mould oil / release agent	As agreed / required	Visual	Once before start of work	As per manufacturer's spec. and as per 3696,4014, 4990, Tech Specs and Const. Drawings					
iii		Acceptance of formwork before start of concreting		BPhysical / visual	Before start of each concreting	As per provisions and tolerances, Tech Specs and Const. Drawings	SR		✓		
3.11 INSPECTION OF CONCRETE SURFACE JUST AFTER REMOVAL OF FORM WORK											
i	Visual inspection jointly with NTPC	Concrete surface, position and alignment of embedded parts and inserts	--BVisual		Once for TG, BFP & MILL foundations	As per provisions and tolerances of equipment supplier, Tech Specs and Const. Drawings			✓		
ii	Submission of grouting / repair methodology if concrete surface / position and alignment of embedded parts / inserts are found defective		--B	Review and approval	once for each type of defect	As per provisions and tolerances, Tech Specs and Const. Drawings			✓		
3.12 EMBEDDED PART(INCLUDING LAYING OF RAILS & ANCHOR FASTENERS)											
i		Position/alignment/level of embedded parts/boothole/pipes/tees/rails/ PVC pipes / etc	As agreed / required	Physical/ measurement	100%	As per drawing, Tech Specs and Const. Drawings	SR/ Protocol		✓		
ii		Welding/tying of embedded reinforcement	As agreed / required	Physical/ measurement	Random in each shift	As per drawing, Tech Specs and Const. Drawings			Exposed surface of the embedded parts other than holding down bolts are to be painted with as per technical specifications		

 SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN										Annexure - V		
		ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INVI, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	Q.P NO. : REV. NO. : DATE : PAGE :	1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	Acceptance Norms		Format of Record					
Sl. No	Contract description (and inspection)	3	Class of check 456789D-10	Type of Check	Q.P NO. : REV. NO. : DATE : PAGE :	1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	Acceptance Norms				Format of Record	
12	3.1.3PRE-CAST CONCRETE	3	456789D-10	Type of Check	Q.P NO. : REV. NO. : DATE : PAGE :	1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	Acceptance Norms				Format of Record	
i	Crushing strength	compression strength testing machine	A	Physical	one sample of six cubes per 50m m3 or part thereof		IS:516 & IS: 456	SR/LB	✓	A minimum of three specimen shall be tested for 7 and 28 days compressive strength				
ii	Workmanship and dimensions	Visual	100%Register				As per IS:456/OWNER Tech. specification.							
iii	Load Test	As required	Physical		1% up to 1000 nos. and 0.5% for more than 1000 nos. for each type		IS:456/ As decided by OWNER Site Engr. In charge.	Inspection Report	✓	Applicable members i.e. drains covers .				
3.1.4JOINTS IN CONCRETE														
i	Joint material-bitumen/impregnated fibre board,PVOwaterstops,Sealing compound,Expanded polystyrene board, Hydrophilic strip, Acrylic polymer etc.	As per manufacturer Standards	A	EIC Approved source and review of MTC/ test reports	Each batch of delivery	MT/ test reports	Tech Specs and Const. Drawings, IS 1838, IS 1834, IS12200		✓					
ii	Acceptance of installation	As agreed / required	Acceptance		Each installation randomly		Tech Specs and Const. Drawings							
3.1.5DAMP PROOF COURSE														
i	Material - Hot bitumen and water proofing materials etc.	As agreed / required	A	EIC A approved source and review of MTC/ test reports	Each batch of delivery at site		Tech Specs and Const. Drawings, IS 702	SR	✓					
ii	Acceptance of damp proof course	As agreed / required	Acceptance	100% SR			Tech Specs and Const. Drawings							
3.1.6GRROUTING														
i	Material	As agreed / required	A	Review of MTC/ test reports	Each batch of delivery	SR	Tech Specs and Const. Drawings		✓					
ii	Type of mix-fluid/mix, plastic/mix, sluff mix etc.	As agreed / required	BF	Physical	to start of work	SR	Tech Specs and Const. Drawings		✓					
iii	Mixing, placement, application and grout pressure	As agreed / required	BF	Physical	Random in each shift	SR	Tech Specs and Const. Drawings							
iv	Compressive strength	As agreed / required	BF	Physical	Random in each shift	SR	Tech Specs and Const. Drawings		✓					
v	Acceptance of the grout	As agreed / required	BF	Physical	Each grout section	SR	Tech Specs and Const. Drawings							
4.00BRICK MASONARY														
4.1Test on Bricks														
4.2Test on Mortar														
i	Compressive strength	As agreed / required	BF	Physical	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof		IS: 1077, IS:13757, IS: 12894 / Tech Specs and const. Drawings	Inspection Report	✓	Efflorescence shall be checked at each source.				
ii	Grading	As agreed / required	BF	Physical			IS 2250-1981, Tech Specs and Const. Drawings							
iii	Workmanship, verticality and alignment	As agreed / required	BF	Physical	100% SR/LB		IS: 2212, IS 1905 , Tech Specs and Const. Drawings	SR/LB						
4.3Masonry construction														
5.00FINISHING AND ALLIED WORKS														
5.1 PLASTERING- MATERIAL														
i	Deleterious Material	As agreed / required	BF	Physical	Once per source	SR	IS : 2386 (Part I &II) & IS : 2116, Tech Specs and Const. Drawings							
ii	Grading	As agreed / required	BF	Physical	50 Cm. or part thereof	SR	Tech Specs and Const. Drawings							

Sl. No	Contract Description	SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN					1PROJECT: 0	PACKAGE: MAIN CONTRACTOR	Khurja TPF (2 X 660 MW) Steam Turbine Generator Island Package		Annexure- V A
			ITEM : CIVIL WORK	QIP NO. : REV. NO. : DATE : PAGE :	Class of check 456789D-10	Type of Check	Quantum Of check			Acceptance Norms	Format of Record	
12	ivGalvanized wire mesh		Silt content	As agreed/ required	BPhysical	EIC Approved source and review of MTC/ test reports	One per 100 cum., or part thereof			CPWD Tech Specs IS 23 86/IS 456/IS 383	SR/LB/ TR	✓
iii			Galvanized hexagonal wire netting for lath plastering	As agreed / required	B		Each batch of delivery	SR		Tech Specs and Const. Drawings		
5.2 PLASTERING - WORKMANSHIP												
i			Curing	As agreed / required	CPhysical	100% SR						
ii			Thickness and finishing of plaster, grooves etc.	As agreed / required	B	Visual/ Measurement	Random in each shift	SR/LB		Tech specifications, construction drawings and agreed methodology		
iii			Trueness of plastering system	As agreed / required	BPhysical	Random in each shift				Tech Specs and Const. Drawings		
5.3 STONE GRIT PLASTER/ GRANULAR TEXTURED COAT FINISH												
i			Material	As agreed / required	B	Approved source and review of MTC	For each lot received at site			Tech Specs and Const. Drawings	SR	✓
ii			Thickness, finishing and grooves etc.	As agreed / required	B	Visual/ Measurement	Random in each shift	SR		Tech Specs and Const. Drawings		✓
6.00 SHEETING AND OTHER WORKS												
6.1 PAINTING SYSTEM - CONCRETE WORKS AND PLASTERED MASONRY SURFACES												
i			Shade, type from brand and manufacturer as approved by NTPC.	As agreed / required	A	Review of MTC/ test reports	Each batch of delivery	SR/LB		Tech Specs and Const. Drawings		✓
ii			Surface preparation	As required	BPhysical	Visual/ Measurement	In each shift			Tech Specs and Const. Drawings		
iii			Acceptance of painted surfaces	As required	BPhysical	Visual/ Measurement	Each surface at random	SR		Tech Specs and Const. Drawings		
6.1.1 PAINTING SYSTEM - STEEL WORKS (OTHER THAN STRUCTURAL STEEL WORKS)												
i			Painting Materials and accessories-A			Review of MTC/ test reports	Each batch of delivery	SR/LB		Tech Specs and Const. Drawings		✓
ii			Surface preparation	As required	BPhysical	Visual/ Measurement	Each Erection Mark	SR		Tech Specs and Const. Drawings, Relevant code/ standards		✓
iii			Primer Thickness	Elcometer B Measurement	Each Erection Mark					Tech Specs and Const. Drawings		✓
iv			DFT of paint	Elcometer A Measurement	Each Erection Mark					Tech Specs and Const. Drawings		✓
v			Acceptance of painted surfaces	Elcometer B		Visual and measurement	Each Erection Mark	SR		Tech Specs and Const. Drawings		
6.2 Modular aerated panel			As required	As required	A	Review of test report	Each batch of delivery	SR/LB		Tech Specs and Const. Drawings		✓
6.3 Permanently colour coated sheets, metal decking												
i			Storage	As required	BPhysical	Visual/ Measurement	Random in each shift	SR		Tech Specs and Const. Drawings		
ii			Installation lap alignment & workmanship	As required	BPhysical	Visual/ Measurement	Random in each shift	SR		Tech Specs and Const. Drawings		
iii			Finishing and acceptance	As required	BPhysical	Visual/ Measurement	Random in each shift	SR/LB		Tech Specs and Const. Drawings		

SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN										1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package		Annexure- V A	
Sl. No	Contract Activity / Subsystem	ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INV. FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		QP NO. : : REV. NO. : : DATE : : PAGE :		Type of Check/ Class of check		Type of Check/ Class of check		Reference Document		Acceptance Norms		Format of Record					
12	6.4INSULATION WORKS			3				45678910											
i	Material	Insulation material, galvanized wire net, aluminium foil, fasteners		As agreed / required		A		EIC Approved source and review of MTC test reports		Tech Specs and Const. Drawings		SR / LB		✓		All tests as per specification			
ii		Acceptance of each type of installation		As agreed / required		Visual/ Physical / test report		Installation SR/LB		Tech Specs and Const. Drawings									
6.5PRE-ENGINEERED BUILDING		Installation and acceptance		As agreed / required		A		EIC Approved source and review of MTC test reports		Tech Specs and Const. Drawings		✓				From approved source / fabricated as per MQP			
7.0DOORS, WINDOWS VENTILATORS & GRILL																			
7.1	Steel doors																		
i		Materials (MS sheet, fasteners, hinges, jamb, stop, weatherstripping etc.)		As agreed / required		A		Visual/ Physical / test report		Tech Specs and Const. Drawings		SR / LB		✓		Review of test report			
ii		Check for shape tolerances, thickness, welding & finishing of sections		As agreed / required		A		Physical & acceptance		Tech Specs and Const. Drawings									
iii	Checking of works	Acceptance of steel glazed doors, windows and T-iron shapes sections after fixing		As agreed / required		B		Physical & acceptance		Tech Specs and Const. Drawings									
iv		Acceptance of fixing after completion		As agreed / required		B		Acceptance Random SR		Tech Specs and Const. Drawings									
7.2 Wood Work																			
i	Wood/Timber/Moisture content			Electrical Moisture meter as per IS 287		A		Physical		Tech Specs and Const. Drawings/ IS 287		SR/LB		✓		To be carried out from Forest Research Institute Dehradun. Frequency of check may be decided by EIC based on quantity and requirement			
ii	Wood work in frames	Check for dimensions, surface finish		As agreed / required		B		Physical		Tech Specs and Const. Drawings		SR							
iii	Flush Door shutter	End emission test, knife test, adhesion test		As agreed / required		A		EIC Approved source and review of MTC test reports		IS 2202, Tech Specs and Const. Drawings		SR		✓		Review of test report			
iv	Particle Door As agreed / required	Acceptance		As agreed / required		A		EIC Approved source and review of MTC test reports		IS:12823, Tech Specs and Const. Drawings		SR		✓		Review of test report			
v		Acceptance		As agreed / required		Visual/ Physical / test report		Random for each installation		Tech Specs and Const. Drawings									
7.3Anodized aluminium works																			
i		Materials- Aluminium sections, Coating		As agreed / required		A		Visual/ Physical / test report		IS:1948, IS: 1949, IS:733, IS:1285, IS:1868, IS:11857/ Tech Specs and Const. Drawings		SR / LB		✓		Review of test report aluminium door/windows, check for anodization as per Tech. Spec			
ii										Tech Specs and Const. Drawings									
iii		Acceptance		As agreed / required		Visual/ Physical / test report		Random SR		Tech Specs and Const. Drawings									

		INDICATIVE FIELD QUALITY PLAN					Annexure- V A			
Sl. No	Contract activity / item description	SUPPLIERS NAME AND ADDRESS:	ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INVIL FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	REV. NO. : DATE : PAGE :		PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package		
				Class of check	Type of Check			Acceptance Norms	Format of Record	
12	7.4 Fire proof doors		3	456789D-10						
i			Source of supply/As agreed / requiredA	Review of purchase order (unpriced copy) / drawings of suppliers / certificate of CBRI	For each sourceSR	Tech Specs and Const. Drawings	✓		Procured from OWNER Approved Source. The door drawing proposed for supply should have been tested and approved by CBRI Rookkee for the similar dimensions for minimum 2 hours fire rating.	
ii			Receipt inspection/As agreed / requiredA	Visual/ Physical/ Review of MTC	For each lot received at site	Tech Specs and Const. Drawings	✓	SR		
iii	7.5 Rolling shutters		Finishing and acceptance As agreed / requiredB	Visual/ Physical/ Review of MTC		Tech Specs and Const. Drawings				
i			Surface finish and thickness of plate of approved make and DFT	Physical / visual / review of MTC	Random for each lot of delivery	Tech Specs and Const. Drawings	✓	SR		
ii			Finishing and acceptance As agreed / requiredB	Physical and	Random SR	Tech Specs and Const. Drawings				
7.6	Steel windows / Grills/ Louvre									
i			Material fabrication and fixturesAs agreed / requiredA	EIC Approved source and review of MTC/test reports	Each lot of deliverySR	IS: 1038 / IS:1361, IS: 7452 and Tech Specs and Const. Drawings	✓			
ii			Finishing and acceptance As agreed / requiredB			IS: 1038 / IS:1361, IS: 7452 and Tech Specs and Const. Drawings	✓			
7.7	Glass and glazing									
i	Clear float glass, wired glass, tinted glass, curtain glass, hermetically sealed glass		Material As agreed / requiredB	EIC Approved source and review of MTC/test reports	For each lot received at site	IS: 14900, IS:1081, IS: 3548, IS:5437 Tech Specs and Const. Drawings	✓	SR		
ii			Installation finishing and acceptanceAs agreed / requiredB	Visual/Physical/RandomSR		Tech Specs and Const. Drawings			Leak proof installation with neoprene gasket	
7.8	Curved dome on roof/ Poly Carbonate Sheet									
i	Source of supply		Impact strength, K value, light transmission value with class 4 fire rating	EIC Approved source and review of MTC/test reports	For each lot received at site	Tech Specs and Const. Drawings	✓	SR		
ii			Installation finishing and acceptanceAs agreed / requiredB	Visual/Physical/RandomSR		Tech Specs and Const. Drawings				

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SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INV, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		QIP NO. : REV. NO. : DATE : PAGE :		1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 x 660 MW) Steam Turbine Generator Island Package					
				Class of check 456789D-10	Type of Check	Quantum Of check	Remarks	Acceptance Norms	Format of Record						
12	Sl. NoContract activity / item / description	3													
7.9	Reflective toughened glass														
i		MaterialsAs agreed / requiredA					EIC Approved source and review of MTC/ test reports	For each lot received at site	Tech Specs and Const. Drawings	SR	✓				
ii		Installation finishing and acceptanceAs agreed / requiredBVisual / physicalRandomSR							Tech Specs and Const. Drawings						
7.10False Ceiling															
i		Materials (gypsum glass, glass fibre membrane, fibre board acoustical tiles etc)		As agreed / requiredA			EIC Approved source and review of MTC/ test reports	For each lot received at site	Tech Specs and Const. Drawings	SR	✓	Compare MTC with technical specification and requirement			
ii		Installation finishing and acceptanceAs agreed / requiredBVisual / physicalRandomSR							Tech Specs and Const. Drawings						
7.11WATER PROOFING															
		Methodology for the application of water proofing system		As requiredBReview				for each type of treatment	Tech Specs and Const. Drawings	SR	✓				
7.11.1 General Requirement- Water Proofing															
i	MaterialsAs agreed / requiredA						EIC Approved source and review of MTC/ test reports	For each lot received at site	Tech Specs /Const. Drawings	SR	✓	MTC shall contain all the parameters specified in the technical specifications			
ii		Acceptance of water proofing workAs agreed / requiredBPhysical100%							Tech Specs and Const. Drawings						
7.11.2 Roof / Basement Treatment															
i	Graded under bedLevels / slopesAs requiredCPhysical100%								Tech Specs and Const. Drawings						
ii	Elastomeric coatingsMaterial- Primer coat, finishing coatAs requiredB						EIC Approved source and review of MTC/ test reports	Each lot of deliverySR	Tech Specs and Const. Drawings		✓				
iii	Wearing courseMaterials - PCC, chicken wire mesh, elastomeric sealant								Tech Specs and Const. Drawings		✓				
iv	Acceptance of water proofing workAs agreed / requiredBPhysical100%								Tech Specs and Const. Drawings						
7.12Fencing and Gates															
i	PVC coated chain link fencing (IS 2720), Welded wire mesh (IS 1566), Reinforced barbed tape galvanized (IS 2629) etc.	MaterialsAs agreed / requiredA					EIC Approved source and review of MTC/ test reports	Each batch of deliverySR	Tech Specs and Const. Drawings		✓	MTC shall contain all the parameters specified in the technical specifications			
ii	Structural steel, painting system, caster wheel, ball and bearing, fixtures and fasteners	MaterialsAs agreed / requiredA					EIC Approved source and review of MTC/ test reports	Each batch of deliverySR	Tech Specs and Const. Drawings		✓	MTC shall contain all the parameters specified in the technical specifications			
iii		Alignments, erection painting, DFT etc.As agreed / requiredB					Physical / measurements	Each installationSR	Tech Specs and Const. Drawings						
iv		Acceptance of the installation and working		As agreed / requiredB			Physical / measurements	Each installationSR	Tech Specs and Const. Drawings						

SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN				Annexure- V A			
ITEM : CIVIL WORK		QP NO. : REV. NO. : DATE : PAGE :		1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	
SUB-SYSTEM : GEOTECH INVIL FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		Type of Check		Quantum Of check		Reference Document		Acceptance Norms	
SI. No		Class of check		Remarks		Format of Record			
7.13		3		456789D-10					
7.13.1		FLOOR FINISHES AND ALIED WORKS							
7.13.1.1		Concrete Flooring							
i		Glass/PVC strips in joints		As agreed / required		Random in each shift		SR	
ii		Finishing and acceptance		As agreed / required		Physical		100%SR	
7.13.2		Tiles							
i		Ceramic, vitrified, glass mosaic, acid alkali resistant, heavy duty cement concrete tiles		Materials		As agreed / required		A	
ii		Finishing and acceptance		As agreed / required		Physical		100%SR	
7.13.3		Interlocking Blocks							
i		Materials		As agreed / required		A			
ii		Finishing and acceptance		As agreed / required		Physical		100%SR	
7.13.4		Kota Stone, Granite and Marble							
i		Quality, texture, thickness, colour for each lot of delivery		As agreed / required		Physical		Each batch of delivery	
ii		Finishing and acceptance		As agreed / required		Physical		100%SR	
7.13.5		Metallic / non-metallic hardener							
i		Materials		As agreed / required		Physical		Each batch of delivery	
ii		Finishing and acceptance		As agreed / required		Physical		100%SR	
7.13.6		Acid / alkali and oil resistant high built seamless epoxy based resin and treatment							
i		Material		As agreed / required		A			
ii		Surface preparation		As agreed / required		Physical		Random in each shift	
iii		Finishing and acceptance		As agreed / required		Physical		100%SR	
7.13.7		Rubber Flooring							
i		Material		As agreed / required		A			
ii		Finishing and acceptance		As agreed / required		Physical		100%SR	

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SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK		QP NO. : REV. NO. : DATE : PAGE :		1PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 x 660 MW) Steam Turbine Generator Island Package						
		SUB-SYSTEM : GEOTECH INVI, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		Type of Check		Quantum Of check		Reference Document		Acceptance Norms		Format of Record				
Sl. No		Contract Activity / Item		Class of check		45678910										
9.0		SPECIAL ITEMS		3												
9.1		Earthing Mat (Grounding System)														
i		Material Earthing mat As agreed / required		A		EIC Approved source and review of MTC/ test reports		Visual/ Measurement		Each lot of delivery as per Specifications		As per relevant IS and Tech. Specs / Manufacturers, IS 3043		SR/MTC	✓	
ii				Weld sizes & length		Visual/Tape		100%		10% at random of the offered lot		Tech Specs and Const. Drawings		TR	✓	OWNER approved electrodes shall be used
iii				D P test		DP test kit						Tech Specs and Const. Drawings			✓	
iv				Earth test		Earth test kit						Tech Specs and Const. Drawings			✓	
9.2		Bitumen layer for tank foundation								Review of MTC/ test reports		Each lot of delivery as per Specifications		SR/MTC	✓	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
i		Material		Grade of bitumen As agreed / required		A		EIC Approved source and review of MTC/ test reports				Tech Specs and Const. Drawings				
ii		Acceptance and workmanship		Application / workmanship As agreed / required		Physical/Random		SR				Technical specifications / drawings		SR/MTC	✓	MTC shall cover all the properties / parameters as per technical specifications
9.3		Composite Aluminium Panels and structural glazing														
i		Material		Type of aluminium panels / structural glazing / fasteners and fixtures / silicon sealant		As agreed / required		A		EIC Approved source and review of MTC/ test reports		Each lot of delivery as per Specifications		SR/MTC	✓	
ii		Acceptance and workmanship		Installation / workmanship As agreed / required		Physical/Random		SR				IS 4558/Technical specifications / drawings		SR/MTC	✓	
9.4		Pressure Relief Valves										Tech Specs and Const. Drawings			✓	
i		Material As agreed / required		A												
ii		Acceptance and workmanship		Acceptance / Installation / workmanship As agreed / required		Physical/Random		SR								
10.0		WEED TREATMENT														
i				Anti-weed treatment materials		As agreed / required		A		EIC Approved source and review of MTC/ test reports		Each batch of delivery		SR	✓	
ii				Execution of treatment		As agreed / required		Physical		Random check for each treatment		Tech Specs and Const. Drawings		SR		
11.0		PILING WORK (If Applicable)														
11.1		Execution														
i				Borehole diameter		As required		100% KSR/LB				OWNER Tech. Specs			✓	If carried out by the contractor

		INDICATIVE FIELD QUALITY PLAN										Annexure- V A		
SUPPLIERS NAME AND ADDRESS:		ITEM : CIVIL WORK				1PROJECT:				PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package		
SI. No Characteristicity (and inspection)		QP NO.: REV. NO.: DATE: PAGE:				Type of Check				Acceptance Norms		Format of Record		
		Class of check				Quantum Of checkRemarks								
12		3				456789D*10								
ii		SR/LB				Pile layoutTotal stationBMeasurement100%SR/LB				As per appd. Drawings and technical		✓		
iii		SR/LB				Recording ground levelAs requiredBMeasurementRandomSR/LB				IS:2911, as per appd. Drawings and technical specification		✓		
iv		SR/LB				Cleaning/Flushing of pile bore As requiredBVisualRandomSR/LB				As per appd. Drawings and technical specification		✓		
v		SR/LB				Size of bore and During boring of pile record commensurate to SPT (core recovery) to ensure socket length equivalent in terms of the Diameter of the pile below the socketing horizon.				As per appd. Drawings and technical specification		✓		
vi		SR/LB				Trial mix to ascertain the workability and cube strength				OWNER tech specification		SR/LB		
vii		SR/LB				Cement contentAs requiredBPhysicalOnce per shiftSR/LB				As per approved design mix.		✓		
viii		SR/LB				Pouring of concrete to project above cut off level.				As per appd. Drawings and technical specification		✓		
ix		SR/LB				Pile termination levelSPT & core recoveryAs per soil data				As per appd. Drawings and technical specification		SR		
11.2 Testing		SR/LB				Once per sourceSR/LB				As per IS:2720 / Tech. Specs.		✓		
i	Bentoni	SR/LB				Density checks on sample of mud collected from pile bore bottom				As per OWNER Tech Spec.		✓		
ii		SR/LB				Slump test of concreteIS:1199BPhysical				IS:2911, As per appd. Drawings and technical specification		SR/LB		
iii		SR/LB				Cube sampling for works cube testsIS:456BPhysical				IS:2911, As per appd. Drawings and technical specification		SR/LB		
iv		SR/LB				Initial pile load test, Vertical (Compression), Lateral (horizontal) and pull-out (tension).				IS:2911, As per appd. Drawings and technical specification		SR/LB		
v		SR/LB				Routine pile tests, compression and horizontal				IS:2911, As per appd. Drawings and technical specification		SR/LB		
vi		SR/LB				Integrity TestsPEMATesting100%				IS:2911, As per appd. Drawings and technical specification		Test Report		
vii		SR/LB								IS:2911, As per appd. Drawings and manual		CHP		

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Sl. No	Contractor's Stamp	SUPPLIERS NAME AND ADDRESS:	ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INVL FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	QP NO. : REV. NO. : DATE : PAGE :	1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package		
							Acceptance Norms	Format of Record	
							Reference Document		
12				Class of check 456789D10	Type of Check	Quantum Of check	Remarks		
12			3						
SHALLOW FOUNDATIONS									
i			Foundation excavation - Location, Layout, size, depth etc.	As required / agreedBPhysicalEach	locationSRlines and levels to be checked		As per technical specifications and construction drawings		
ii			Foundation casting - Layout, Shape, dimensions, Reinforcement, concreting, curing etc.	As required / agreedBPhysicalEach	foundationSR		As per technical specifications and construction drawings		lines and levels to be checked, Concrete Grade to be checked as per Mix Design
13. ROAD WORKS									
13.1			Tests on Embankment, Subgrade Construction and Cut Formation						
A) Suitability of Borrow Fill material									
i			Sand ContentAs per IS 2720APhysical		2 tests per 3000 cum of soil		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part IV)	SR/TR	✓
ii			Plasticity TestAs per IS 2720APhysical		Each type to be tested, 2 tests		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part V)	SR/TR	✓
iii			Density TestAs per IS 2720APhysical		Each soil type to be tested, 2 tests		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part VIII)	SR/TR	✓
iv			Deleterious Content TestAs per IS 2720BPhysical		As and when required by Engineer in charge		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XXVII)	SR/TR	✓
v			Moisture Content TestAs per IS 2720APhysicalTwo TestsSR/TR				As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part II)		✓
vi			CBR TestAs per IS 2720APhysical		One CBR test (Avg. of three specimens) or closer as and when required by EIC		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XVI)	SR/TR	✓
vii			Free swell indexMeasuring CylinderAPhysical		Once per each type of source or change of source		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XI)	SR/TR	✓
B Compaction									
i			Standard proctor Test As per IS: 2720APhysical		One in every 2000 cum for each type and source of fill materials		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (PL VII)	SR/TR	✓
ii			Moisture content of fill before compactionAs per IS: 2720BPhysical		One in every 2000 cum for each type and source of fill materials		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (PL II)	SR/TR	
iii			Dry density by core cutter method OR Dry density in place by sand displacement method		One in every 2000 SQM area for each compacted layer.		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (PL XXIX)/ IS 2720 (Pt. XXVIII).	SR/TR	✓
iv			Lines, grade and cross sectionAs required / agreedBPhysical		One in every 500 SQM area		As per Tech Specs and Const. Drawings	SR/Template	straight edge

SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN				Annexure- V			
Sl. No	Contract Activity / Implementation	ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INV, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		QP NO. : REV. NO. : DATE :		1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	
		Class of check	Type of check	Quantum Of check	Remarks			Acceptance Norms	Format of Record
12				3	456789BD-10				
1.5	Premix Bituminous Macadam (BM)								
i	Quality of binder	Penetrometer with St. needle	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8837 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	✓	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii	Aggregate Impact Value / Los Angeles Abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 200 cum of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
iii	Combined Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 350 cum for each source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
v	Water absorption of aggregate	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
vi	Water sensitivity of mix	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
vii	Grading of aggregates	Set of Sieves	B	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
ix	Percentage of fractured faces	As required / agreed	B	Physical	one test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
x	Binder content	Bitumen extractor	A	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
xi	Control of Temperature of binder and aggregate for mix and of the mix at the time of laying and rolling	Thermometer	B	Physical	regular intervals	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification		✓	
xii	Density of compacted Layer	As required / agreed	A	Physical	One test per 700 Sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓	
xiii	Rate of spread of mixed materials	As required / agreed	B	Physical	Regular Interval	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification		✓	

INDICATIVE FIELD QUALITY PLAN										Annexure- V		
Sl. No	SUPPLIERS NAME AND ADDRESS:	ITEM : CIVIL WORK				1PROJECT:		PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 x 660 MW)		APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES	
		SUB-SYSTEM : GEOTECH INV, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.				0			Steam Turbine Generator Island Package			
		REV. NO. : DATE : PAGE :		Type of Check		Reference Document			Acceptance Norms			Format of Record
Fract activity / condition		Class of check		Remarks								
12		3		456789D-10								
1.6	Bituminous Concrete											
i		Quality of binder	Penetrometer with St needle	APhysical		Number of samples per lot and tests as per IS:73 or IRC-SP-53, IS:15462		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	✓		
ii		Aggregate Impact Value / Los angels abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	APhysical		One test per 350 cum of aggregate for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
iii		Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	BPhysical		One test per 350 cum of aggregate for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
iv		Soundness Test (Magnesium and As required as per Sodium Sulphate)IS:2386		A	Physical	One test for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
v		Water absorption of aggregatesAs required / agreed	BPhysical			One test for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
vi		Sand equivalent testAs required / agreed	BPhysical			One test for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
vii		Plasticity IndexAs required / agreed	BPhysical			One test for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
viii		Polished stone valueAs required / agreed	BPhysical			One test for each source and whenever there is change in the quality of aggregate		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
ix		Percentage of fractured facesAs required / agreed	BPhysical			One test per 350 cum of aggregate when crushed gravel is used		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
x		Mix GradingSet of SievesBPhysical				One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		
xi		Stability and voids analysis of mix including theoretical maximum specific of loose mix	As required / agreed	BPhysical		Three tests for stability, flow value, density and void contents for each 400 tonnes of mix subject to minimum of two tests per day per plant		As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓		

Sl. NoContract Activity / Implementation		SUPPLIERS NAME AND ADDRESS:	INDICATIVE FIELD QUALITY PLAN					1PROJECT: 0	PACKAGE: CONTRACT NO. MAIN CONTRACTOR	Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package			Annexure- V A
			ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INVI, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	OP NO. : REV. NO. : DATE : PAGE :	Class of check	Type of Check	Quantum Of check			Remarks	Acceptance Norms	Format of Record	
12			3	456789D-10			One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
xii			Moisture Susceptibility of mix (AASHTO T283)	As required / agreed	APhysical			As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
xiii			Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	Thermometer	BPhysical	regular intervals	SR/TR	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification		✓			
xiv			Binder content Bitumen extractor	APhysical			One set for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
xv			Rate of spread of mixed materials	As required / agreed	BPhysical	After every 5th truck load	SR/TR	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification		✓			
xvi			Density of compacted Layer	As required / agreed	APhysical		One test per 700 Sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
1.7	Premix surfacing and Seal coat												
i			Quality of binder	Penetrometer with SI needle		APhysical	Number of samples per lot and tests as per IS 73, IS 217 and IS 8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	✓		APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES	
ii			Aggregate Impact Value / Los Angeles Abrasion value	Aggregate Impact Value/Los Angeles Test apparatus		APhysical	One test per 200 cum of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
iii			Combined Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge		BPhysical	One test per 100 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
iv			Stripping value of aggregate (Immersion tray test)	As required / agreed	BPhysical		one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
v			Water absorption of aggregate	As required / agreed	BPhysical		one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
vi			Water sensitivity of mix	As required / agreed	BPhysical		one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
vii			Grading of aggregates	Set of Sieves	BPhysical		Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
viii			Soundness (Magnesium and Sodium Sulphate)	As required as per IS 2386		APhysical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			
ix			Polished stone value	As required / agreed	BPhysical		one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	✓			

		INDICATIVE FIELD QUALITY PLAN										Annexure- V A	
		SUPPLIER'S NAME AND ADDRESS:		ITEM : CIVIL WORK SUB-SYSTEM : GEOTECH INV/L FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.		QIP NO. : REV. NO. : DATE : PAGE :		PROJECT: 0		PACKAGE: CONTRACT NO. MAIN CONTRACTOR		Khurja TPP (2 X 660 MW) Steam Turbine Generator Island Package	
Sl. No	Ch	Activity / Implementation	Class of check	Type of Check	Quantum Of check	Remarks	Reference Document	Acceptance Norms	Format of Record				
12			3	456789D-10									
14.0		GEOTECHNICAL INVESTIGATION WORK											
i		Deployment of approved Geotechnical Investigation Agency-Equipments, Manpower etc.	As required / agreed	Physical		Once before commencement of work		As per technical specifications and relevant IS Codes	SR	✓			
ii		Execution of Geotechnical Investigation- locations, type etc. as per scheme	As required / agreed	B	Physical	Each Location.		As per technical specifications and relevant IS Codes	SR	✓			
iii		Collection of disturbed and undisturbed samples, their packing and storage	As required / agreed	B	Physical	Each Location.		As per technical specifications and relevant IS Codes					
iv		Conducting field tests as per investigation scheme such as SPT, CPT, PLT, PMT etc.	As required / agreed	B	Physical	Each Location.		As per technical specifications and relevant IS Codes					
v		Submission of Field Bore log as approved format	As required / agreed	B	Physical	Within 24 hours after completion of each BH		As per technical specifications and relevant IS Codes	SR	✓			
vi		Submission of laboratory test schedule and selection of samples for laboratory testing	As required / agreed	A	Physical	As per consultation with engineer during dispatch of samples to approved laboratory		As per technical specifications and relevant IS Codes	SR	✓			
vii		Submission of Final Geotechnical investigation report along with recommendations	As required / agreed	B	Physical	After completion of investigation work and review of draft reports		As per technical specifications and relevant IS Codes	-	✓			
Legend to be used: Class # : A = Critical, B = Major, C = Minor; SR, TR, MTC, LB Categorization Witnessing & Accepting (As per OWNER QA&I System) Category 'A' FQA Engineer in association with Executing Engineer, Category 'B' Executing Engineer, Category 'C' Executing Engineer ; SR = Site Register, TR = Test Report, MTC = Manufacturer's Test Certificate This document shall be read in conjunction with OWNER Tech. Specifications, BOQ, Drawings													
Manufacturer / Sub-supplier	Main-supplier		For OWNER USE										
Signature		REVIEWED BY: APPROPRIATE											

INDICATIVE FIELD QUALITY PLAN													ANNEXURE- V B			
SUPPLIERS NAME AND ADDRESS:		ITEM : STRUCTURAL STEEL WORK		Q.P. NO. : 2		PROJECT: Khurja TPP (2 X 660 MW)		CONTRACT NO.		MAIN CONTRACTOR		Remarks				
		SUB-SYSTEM : FABRICATION & ERECTION		REV. NO. :		DATE :		CONTRACT NO.		MAIN CONTRACTOR		Remarks				
		PAGE :		PAGE :		PAGE :		PAGE :		PAGE :		PAGE :				
		PAGE :		PAGE :		PAGE :		PAGE :		PAGE :		PAGE :				
Sl. No	Activity and operation	Characteristics / Instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks					
1.00	2	3		4	5	6	7	8	9	D*	10					
i	MATERIALS	Structural steel procured from OWNER approved sources- Mechanical (YS, UTS, Elg, UT if specified), and Chemical properties (CF as per IS)		A	Review	For each hatch of each section delivered at site	Technical Specification and Construction Drawings, IS 2062		SR	✓	Correlated MTC shall be verified. In the event of non submission of MTC, sample shall be selected by FOA for testing as per specification.					
2.00	FIT-UP															
i		Marking and Cutting		B	Visual & Measurement	Each plate/ Section	Tech Specs and Const. Drawings/ Approved cutting plan		SR							
ii		Match markings for trial assembled components		B	Physical	Each fit-up	Tech Specs and Const. Drawings		SR							
iii		Weld Fit Up		B	Physical	Each fit-up	Tech Specs and Const. Drawings		SR	✓	Edge Preparation/ Gap/ Alignment					
3.00	PRE HEATING (wherever applicable)															
i		Pre-Heating Temperature		B	Measurement	Each pre-heating	Tech Specs and Const. Drawings, Approved WPS		SR	✓						
ii		Post Weld Heat Treatment (PWHT), if required		A	Time & Temperature	Each PWHT	Tech Specs and Const. Drawings, Approved WPS		SR	✓						
4.00	WELDING REQUIREMENTS															
i		PQR and Welder's Qualification		A	Physical	Each welder	Approved WPS/ PQR, AWS-D1, /ASME-IX, Tech Specs and Const. Drawings		Test Report	✓						
ii		Welding consumables		B	Physical	Random in each shift	Approved WPS/ Owner Rationalized list of Electrodes		SR	✓						
iii		Sequence of welding		B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR							
iv		Removal/ grinding of temporary attachments		B	Measurement	All cleats/ attachments	Tech Specs and Const. Drawings, IS-7215		SR							
v		Completeness after welding- Dimensions/ distortion		B	Visual	Each structure component	Tech Specs and Const. Drawings		SR							
5.00	NON DESTRUCTIVE AND DESTRUCTIVE TESTING															
5.01	Fillet Welds															
i		Visual		B	Visual/ Measurement	Each welded joint	As per technical specifications and construction drawings		SR		As per requirement of Owner Engineer					
ii		Macro-Etch Examination		B	Physical	Main fillet weld with min one joint per built up beam, columns and crane girders	As per technical specifications and construction drawings		SR	✓						
iii		Dye Penetration Test (DPT)		B	Physical	25% weld length of tension member of crane girder- For crane girder 5% of Weld length with min. 300mm at each location - Except Crane Girder, for all other Fillet Welds	As per technical specifications and construction drawings		SR	✓						
5.02	Butt Welds															

 SUPPLIERS NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN										ANNEXURE- V B									
		ITEM : STRUCTURAL STEEL WORK				QP NO. : 2		PROJECT: Khuria TPP (2 X 660 MW)		Remarks											
		SUB-SYSTEM : FABRICATION & ERECTION				REV. NO. :		Steam Turbine Generator Island Package													
		DATE :				PAGE :		CONTRACT NO.													
Sl. No		Activity and operation		Characteristics / Instruments		Class of check		Type of Check		Quantum Of check		Reference Document		Acceptance Norms		Format of Record					
						3		4		5		6		7		8		9		D*	
1		2		3		As agreed / required		Physical		Each surface at random		Tech Specs and Const. Drawings		SR		10					
iv				Acceptance of painted surfaces				Physical													
12.00		PERMANENT BOLTS AND NUTS AND WASHERS																			
i				Material		As agreed / required		A		Physical and MTC Review		Once for each lot of delivery		Tech Specs and Const. Drawings		SR/MTC		All bolts, nuts and washers for connections shall be conforming to relevant IS as given in the Tech. Spec/ Construction Drawing			
ii				Contact surfaces before bolting		As agreed / required		B		Physical		Random before assembly for bolting		Tech Specs and Const. Drawings, IS 4000		SR					
iii				Inspection of the assembled bolts		As agreed / required		B		Physical		Randomly in each shift for assembled bolts		Tech Specs and Const. Drawings, IS 4000		SR					
iv				Tensioning		As agreed / required		B		Physical		Randomly during snug tight test and after full tensioning		Tech Specs and Const. Drawings, IS 4000		SR		✓			
v				Acceptance of installed bolts		As agreed / required		B		Physical		Each bolt		Tech Specs and Const. Drawings		SR					
13.00		ELECTROFORGED GRATINGS																			
i				Material from approved source		As agreed / required		A		Physical and CHP Review		Once for each lot of delivery		Tech Specs and Const. Drawings		SR/MTC		✓		Also refer the approved MQP	
ii				Acceptance of Erection, alignment and each Installation		As agreed / required		B		Physical		100%		Tech Specs and Const. Drawings		SR					
14.00		STAINLESS STEEL HAND RAILS																			
i				Material		As agreed / required		A		Physical/MTC Review(In case procured by contractor)		Once for each lot of delivery		Tech Specs and Const. Drawings		SR/MTC		✓		Also check grade of steel	
ii				DPT for welding		As agreed / required		A		Physical		Random for each fabrication		AWS D1.1 / Tech Specs and Const. Drawings		SR/ R		✓		WPS shall be submitted for Owner approval . electrodes used shall be as specified in WPS	
iii				Acceptance of stainless steel hand rails		As agreed / required		B		Physical		Each installation		Tech Specs and Const. Drawings		SR					

SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN					ANNEXURE- V B				
		ITEM : STRUCTURAL STEEL WORK		Q.P. NO. :	2	PROJECT: Khurja TPP (2 X 660 MW)					
		SUB-SYSTEM : FABRICATION & ERECTION		REV. NO. :		CONTRACT NO.					
				DATE :		MAIN CONTRACTOR					
				PAGE :							
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		
15.00	PTFE SLIDING BEARINGS AND ELASTOMERIC BEARINGS										
i	Material from approved source	As agreed / required	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	✓		
ii	Acceptance of installation of bearings	As agreed / required	B	Physical	Each installation	Tech Specs and Const. Drawings		SR			
				LEGEND: D = Records, identified with "Tick" (✓) shall be essentially included by supplier in QA documentation			DOC. NO. : REV: 0				
				Legend to be used: Class # : A = Critical, B=Major, C=Minor, SR, TR, MTC, LB							
Manufactur er/ Sub- supplier	Main-supplier			Categorization Witnessing & Accepting (As per Owner QA&I System) Category 'A' FQA Engineer in association with Executing Engineer, Category 'B' Executing Engineer, Category 'C' Executing Engineer; SR = Site Register, TR= Test Report, MTR TC = Manufacturer's Test Certificate			For Owner USE				
Signature		This document shall be read in conjunction with Owner Tech. Specifications, BOQ, Drawings				REVIEWED BY	APPROVED BY	APPROVAL SEAL			