नॉर्थ ईस्टर्न इलेक्ट्रिक पावर कॉर्पोरेशन लि.
(भारत सरकार का उधम)
NORTH EASTERN ELECTRIC POWER CORPORATION LIMITED
(A Government of India Enterprise)
OFFICE OF THE EXECUTIVE DIRECTOR, CONTRACTS & PROCUREMENT
Brookland Compound, Lower New Colony, Shillong-793 003, Meghalaya, India
E-mail : contract@neepco.co.in
Website : www.neepco.co.in ; CIN – U40101ML1976GOI001658
ISO: 9001, 14001, & 45001

Corrigendum No.02 dated 08-08-2023

To

NIB No.432 dated 13-07-2023

Name of Work: **Repairing and Re-strengthening of Cooling Tower at Plant area AGBPS NEEPCO Ltd. Bokuloni Dist Dibrugarh Assam**

Following corrigenda to the bid document are hereby issued.

1. Part-4: Conditions of Contract,

   APPENDIX-V: MODEL QUALITY ASSURANCE PLAN
   The Model Quality Assurance Plan for the work stands modified as attached herewith.

2. Clause 6.1 (ii) (d) "Valid Trade License" under **General Qualifying Requirement** Part-1, NIB, Detail Notice Inviting Bids stands **deleted**.

08/08/2023

Chief General Manager (C)
Contracts & Procurement

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NIO

Memo No. QP/C&P/F/C/AGBPS/C/J.S-20/38/ VOL-1/C2/402-406 **Dated: 08.08.2023**

1. The Director (Technical), NEEPCO, Guwahati for favour of kind information please.
2. The ED(O&M), NEEPCO, Guwahati, for favour of kind information please.
3. The CGM(F), Concurrence, NEEPCO, Shillong for favour of information please.
4. The HOP, AGBPS, NEEPCO, Bokuloni, Dist- Dibrugarh, Assam for favour of information please.
5. The GM (IT), NEEPCO, Shillong for information please. It is requested to arrange for uploading this Corrigendum No. 02 dated 08-08-2023 at NEEPCO Website.

08/08/2023

Chief General Manager (C)
Contracts & Procurement

NORTH EASTERN ELECTRIC POWER CORPORATION LTD

(A GOVT. OF INDIA ENTERPRISE)

ISO: 9001
ISO: 14001
ISO: 45001

Repairing and Renovation work of Cooling Tower in the Plant Area of AGBPS, NEEPCO Ltd, Bokuloni, Dist.Dibrugarh, Assam

MODEL QAP

CONTENTS

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1.0 GENERAL:

The actions taken by an intending contractor to provide and document assurance in respect of quality of works what are proposed to be executed shall be in accordance with the contract documents and standards of good practice of construction works. The Quality Assurance Plan (QAP) of the contractor is therefore a documental assurance by the contractor based on the tender document namely the model QAP. The documental assurance i.e. QAP of the contractor/ bidder prepared as per the requirement of model QAP of the tender documents shall be submitted by him along with his bid document.

The QAP of the contractor for the instant proposed contract shall therefore be to ensure that the execution of the work of **Repairing and Renovation work of Cooling Tower in the Plant Area of AGBPS, NEEPCO Ltd, Bokuloni, Dist.-Dibrugarh, Assam** under the scope of the Contract to be performed by the Contractor or his Sub-Contractor are in accordance with the national or international standards & specification of works. Testing of all construction materials to be used for any structural work/s shall be done as per the relevant BIS standards / codes to ensure its quality and suitability for the given / approved repair methodology based on approved technical specification. All construction materials shall be tested by the contractor for assessing the suitability of the materials prior to usage in construction works as per latest editions of BIS codes of practice.

Any material/s procured from vendor/s shall have its manufacturer's test certificate and shall be used only as per manufacturer's specification and approved methodology. Suitability of materials for a particular type of damage shall be ensured as this may lead to high cost and failure of repair, if the materials used are unsuitable. Care shall be taken during batching, mixing, proportioning, handling and placement of materials to ensure good quality control.

For such quality assurance, the Contractor shall adopt suitable Quality Assurance Program / Plan (QAP) to control his activities at all points of execution process as necessary. Such plan / program shall be outlined by the Contractor and shall finally be accepted and approved by the Corporation before finalization of the Contract.

The QAP of the Contractor shall generally cover the following:

a) Organizational structure / set-up at field execution site for the management and implementation of the Contractor's proposed QAP dully approved by the Corporation.

b) Documentation of control system and process for records relating to requirements of quality

system reviewed and approved for adequacy before use.

c) Qualification data for Contractor's key personnel at execution site and for Field Quality Control (FQC) activities.

d) The procedure for purchase & procurement of all construction materials like cement, steel reinforcement, structural steel, plasticizers, admixtures etc. and for selection of sub-contractor's / vendor's services including vendor analysis, their source inspection, incoming construction material inspection, verification of material purchases etc.

e) List of all tests / checks to be carried out for assessing the suitability of construction materials like cement, concrete aggregates, water for concreting works etc. at the project level and also during site tests / pre-commissioning checks etc. in accordance with national or international standards of practice or approved drawings as the case may be. List shall be detailed as follows so as to identify the tests / checks to be witnessed by the Corporation.

- Important checks and requirement as per technical specifications which describe the level of checks, codes, critical tests and also indicate place where testing is planned to be performed.
- Suitability of construction materials and the test checks before being used in execution in accordance with contract specifications and relevant national or international standards.
- Inspection which describes quality checks and verification required during execution level at project site.
- Final Inspection which describes quality checks and verification required before final acceptance of the executed works by the Project Authority.

f) Field Quality controls including execution process control supported by a FQAP (Field Quality Assurance Plan) to be accepted and approved by the Corporation. FQAP for the civil works under the scope of the contract is broadly classified for material testing, execution activities, testing and commissioning of executed civil works.

g) The FQAP of the contractor shall therefore include the following:

- Checks on receipt of construction materials like cement, steel materials (both structural & reinforcement), concrete admixtures, grout materials etc. as per actual requirement for completion of the works as per approved technical specification of works under the scope of the contract.
- Planning & checks for storage / buffer storage of construction materials.
- Testing & checks during execution of works.

- Availability of tools and man power, drawings, materials required for execution, execution methodology, test procedure, tests required before commissioning.
- Checks & controls during execution and commissioning.
- Protocols points (joint records of checks) to be identified.
- Detailed process for controlling non-conforming products / executed works and system for corrective works.

h) To identify the list of any sub-contractor / vender.

i) A detail PERT network showing the various activities such as mobilization of resources to construction site, execution activities, field testing & QC activities, pre-commissioning, commissioning etc. as may be required before & after execution of works.

j) Inspection and test procedure both for procurement of all construction materials and field activities.

k) Control of calibration and testing of measurement and field activities.

l) System for indication and appraisal of inspection status.

m) System for quality audits.

n) System for maintenance of records.

o) System for handling storage and delivery.

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2.0 QA DOCUMENTS:

2.1 The Contractor shall be required to submit the following Quality Assurance Documents on receipt of all procured construction materials like cement, steel, admixtures etc. at the project site.

- All test reports like Material Test Certificates (MTC) or Certificate of Conformance (CoC) as the case may be in respect of all materials procured by the Contractor.
- All construction Materials test report as specified by the specification and agreed to in the Quality Assurance Plan.
- The Quality Plan with verification of various inspection as mutually agreed and methods used to verify that the inspection and testing points as required to determine the suitability of construction materials and execution activities are performed satisfactorily.
- All approved NDT (Non-Destructive Test) procedures required to be carried out during the progress of the project work.

2.2 At the project level, following document control procedures shall be followed during execution of works:

a) Contractor's Quality Control Instruction Manual.
b) Site Order Book.
c) Material Control Records.
d) Daily Progress Report.
e) Drilling & Grouting log records
f) Test Report Control.
g) Non-Conforming item records.
h) Other relevant records as decided by the EIC.

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3.0 Contractor's QA/QC duties:

The contractor's QA/QC duties are summarized in the table below. Apart from these, other duties shall be performed as per the contract documents or as directed by the Engineer-In-Charge for completion of the works as per technical specification of works. It is therefore essential to keep certain documents at site for making a permanent record of each and every items of the works related to the project. Such items may include tests conducted at site, test certificates, instructions issued to contractor, record of drawings issued to the contractor, inventory of the material at site. All such site documents as mentioned at **Cl.No. 2.0** play an important role in assuring the quality of the work. All these documents shall have a definite identification number.

Sl.No.	Activity / Item	Contractor's QA/QC Duties
1	Drawings for thecontract	• To Maintain drawing register at site. • To use only approved drawings for construction works.
2	Material receipts & materials testing.	• To enter receipts in material register. • Materials to be tested only in approved laboratories. • To use only approved mix proportions of concrete / grout mix. • To take test samples in presence of NEEPCO's representative when requested. • To perform material tests. • To submit test reports to the EIC. • To maintain test log.
3	Rejected materials	• Entries to be made in material register at site. • To tag and record all rejected materials. • To intimate EIC in writing the proposed date of removal of such rejected materials from site and confirm after removal.
4	Material consumption	• To enter daily consumption of materials in material register and indicate balance quantity.
5	Construction equipment	• To intimate EIC the details, date of mobilization along with requisite insurance certificate. • To maintain equipment's in good working condition.

		• To intimate breakdown of construction equipment's.
6	Construction activities	To intimate the EIC in advance when critical works such as Application of Corrosion Protective Coating, Application of modified Mortar, Injection of Epoxy/Cementitious Grouting, Application of Anti-Carbonation Protective Coating, Application of Multi Surface Painting, etc. would be undertaken along with the test certificates of the materials proposed to be used in these works. No critical activity shall start unless the material is tested, certificates are verified and approved by EIC
7	Daily Work Progress	• To maintain in daily log records.
8	Inspection of EIC or his representative	• To take instructions in Site Order Book. • To intimate EIC of compliance.
9	Work progress scheduling and control	• To prepare and maintain project schedules and undertake work in accordance with approved schedule.
10	Reporting	• To prepare and submit Monthly Progress Reports and other reports as per contractual requirements.
11	Records	To maintain the following records on Site/Contractor's Office/Laboratory as given below: • Site Order Book. • Material Register. • Daily Progress Report. • Manufacturer's Test Certificates Record. • Drawing Records. • Non-conformity items record. • Others as per requirement of the contract.
12	Workmanship	All the work executed against the contract shall be of good workmanship.
13	Disposal of debris	All the debris should be disposed of properly after completion of the work.

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4.0 Contractor's QA Compliance on approved QAP:

The Contractor shall establish staff, equip and operate a comprehensive quality assurance set-up at the site and shall ensure to remain under operation throughout the currency of the contract. The principal responsibility and duty of this set-up shall be to ensure that all works carried out and materials procured by the Contractor for the works comply fully with the specifications or relevant BIS or International codes.

With his tender, the contractor shall submit his detailed proposal (in terms of experienced supervisory staff, trained workmen & welders, procedures of work, equipment, obtaining support from outside agencies) for achieving quality in respect of all works included in the scope of work under this proposed tender.

The contractor's proposal for FQAP shall be specific enough to assure that all works are executed in a professional manner and contractor has included in his bid the provision of employment of the best international practices of construction in the implementation of the work. Within 30 days of award of works, the contractor shall prepare and submit **detailed QAP** along with his Field Quality Assurance Plan (FQAP) for obtaining approval of the Engineer-In-Charge. All works shall be executed based on approved QAP.

Immediately after the award of work, during mobilization phase, the Contractor shall take systematic steps to implement all the proposals given by him for achieving the desired quality in execution activities. In addition, contractor shall have to submit comprehensive QA and QC plan in line with technical specifications and relevant codes referred in the technical specifications forreview and approval of Engineer-in-charge.

Quality and durability of the civil work depend on the workmanship during execution process. The aim of work is to provide strength and durability to the structure. For this, the workmen involved in execution shall have sufficient knowledge, skills and training to perform the work. Work carried out shall be done in a manner such that the durability requirement is met. All these processes involved shall therefore be carefully supervised by experienced personnel. Well trained, competent workmen are particularly essential when applying Deckguard E-2000 ot Masterseal 878 of BASF or equivalent, applying SBR Polymer, Grouting etc or other such specialized items are involved.

Selection of right procedures is essential to ensure that the quality control for which appropriate techniques are carefully performed. Wrong procedure and workmanship may lead to non-achievement of the desired objective.

One of the common problems that leads to premature failure of any civil work is improper curing, especially cementitious materials which cause early cracking. Recommended curing

method is to leave the forms in place when using form-and-pour applications, ponding, continuous moist curing, and curing membranes.

During the course of execution of the work, quality of the work in progress shall be reviewed at least once in a month or as per the project requirement in the Quality Assurance meeting specifically called by the Engineer-In-Charge and participated by Contractor's project organization. In case, the Engineer-In-Charge is not satisfied with the resources employed vis-a- vis the commitments made in the proposal, the contractor shall take additional steps to supplement his efforts.

The Contractor's personnel connected with quality control assignments at the field level must possess the relevant expertise and competence to perform specific tasks connected with quality control works and shall be well conversant with testing of construction materials and testing procedures for execution of the civil works as per the relevant national or international standards and codes of practice. The objective of quality control shall be clearly understood by them in letter and spirit so as to achieve desired quality in executed works and to achieve high order of quality as laid down in specifications by controlling various factors responsible for deterioration in quality, investigating reasons there and suggesting ways and means for improvement.

The Contractor shall assign one experienced engineer-in-charge to the project site for quality control and quality assurance as full-time **Quality Control Manager**, responsible for complying with all requirements of technical specifications. A check list shall be prepared for incorporating all the technical specifications requirements under different works and shall be displayed in the quality control establishment for ready reference. The experience and qualifications of this engineer shall be given in the contractor’s tender and shall be subject to the approval of the Engineer-in- charge.

The positions, qualifications and duties of the contractor’s quality control staff shall be indicated in the QC organization plan, and shall likewise be subject to approval by the Engineer-in-charge.

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5.0 Types of inspection & QC tests & checks to be carried out:

There are different types of civil works involved under the scope of the contract like, applying Deckguard E-2000 ot Masterseal 878 of BASF or equivalent, applying SBR Polymer, Grouting , Steel Reinforcement work, etc. The FQAP being a part of the contractor's QAP shall consist of detailed checks & description of test, sampling plan at various stages of material receipt, storage, handling, sampling procedure, pre-assembly, assembly, mandatory physical & laboratory testing prior to usage. Acceptance criteria shall be with reference to approved technical specification of works and acceptance norms like BIS or International codes of practice, approved drawings etc., recognized testing agency, remark and check for acceptance /deviation. The submitted FQAP in the overall QAP shall be in line with national / international standards, approved drawings / data sheet and contract specification. This shall also contain statutory testing requirements so as to satisfy the technical specification as stipulated in the contract.

Following broad based general inspection & QC tests & checks shall be carried out by the contractor during execution of the civil work under the scope of the contract in accordance with the approved technical specification & methodology of works as per contract documents of the civil work.

5.1 DISMANTLING & DEMOLITION OF EXISTING STRUCTURES:

- The Work shall be performed to the dimensions as shown on the drawings or as otherwise directed by the Engineer-in-Charge.
- The approval given by the Engineer-in-Charge to the Contractor’s plants and equipment or their operation or of any methods shall not relieve the Contractor of his full and sole responsibility for the proper and safe execution of Work or any obligations under this Contract.

5.2 STEEL FOR REINFORCEMENT:

The Contractor shall produce the detailed bending schedules and placing drawings. These drawings shall be based on the outline reinforcement plans provided by the Engineer-in-Charge and subject to his approval.

5.2.1 Standards:

The cutting, welding, placement and binding of reinforcing steel shall conform to following Indian Standards or, where not covered by these Standards, to their equivalent International Standards, subject to the approval by the Engineer-in-Charge.

IS: 280 Mild steel wire for General Engineering purposes.
IS: 432 Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
IS: 456 Code of practice for plain and reinforced concrete.
IS: 814 Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
IS: 1566 Hard-drawn steel wire fabric for concrete reinforcement.
IS: 1608 Mechanical testing of metals – tensile testing.
IS: 1786 High strength deformed-steel bars and wires for concrete reinforcement.
IS: 2062 Hot Rolled Medium & High Tensile Structural Steel.

IS: 2502 Code of practice for bending and fixing of bars for concrete reinforcement.
IS: 2751 Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.
IS: 5525 Recommendations for detailing of reinforcement in reinforced concrete works.
IS: 9417 Recommendations for welding cold worked bars for reinforced concrete.
In case of conflict between the above Standards and the Specifications given herein, the decision of Engineer-in-Charge should prevail.

5.2.2 Material:

The reinforcing bars shall meet the requirements of IS: 1786 (latest revision) and other relevant Indian Standards. Steel of high yield strength deformed bars conforming to IS: 1786 (latest revision).

5.2.3 Fabrication:

i) All bars shall be cut and bent in accordance with the bar bending schedules made by the Contractor which have been previously approved by the Engineer-in-Charge.
ii) Reinforcing steel bars shall be cut and bent on the Site of the Works or at a fabricator's plant. Notwithstanding the above, a bar-bending machine and a representative stock of reinforcing steel shall be maintained on the Site, sufficient to allow minor revisions and additions to be carried out as required by the Engineer-in-Charge.
iii) Reinforcing steel shall not be straightened or re bent in a manner that will damage the materials. Bars with kinks or bends other than those indicated on the drawings and schedules shall not be used.
iv) Shorter lengths of steel shall not be used in places where continuous lengths are required as per the drawings without the approval of the Engineer-in-Charge. Shorter bars, if approved for use, shall be lapped or spliced to achieve continuity in accordance with the requirements of relevant Indian Standards or as approved by the Engineer-in-Charge.
v) Bars shall be bent cold to the shape and dimensions shown on the drawings using a bar bender operated by hand or power to attain the proper radii of bends.
vi) A standard 180-degree hook at the end of a reinforcement bar, if used, shall have an inner diameter not less than six times the diameter of the bar, up to a bar or 25 mm diameter, and shall have length of straight part beyond the curve of at least four times the diameter of the bar. Hooks shall be used only where shown on drawings or as required by the Engineer-in-Charge. The radii of bends for stirrups and ties shall not be less than four times the diameter of the bar for up to bars 16 mm in diameter, and six times the diameter for bars up to 25 mm diameter.
vii) Heating of reinforcement bars to facilitate bending shall not be permitted.
viii) The reinforcement available from rejected reinforced concrete shall not be used without prior approval of the Engineer-in-Charge.

5.2.4 Splicing of Reinforcement Bars:

i) Wherever it is necessary to splice reinforcement, the splices shall be made by lapping, or by mechanical means.
ii) The steel bars shall be joined by providing lap joints in accordance with the requirements of the relevant Indian Standards or as approved by the Engineer-in-Charge. Splices at points of maximum stress shall however, be avoided. Splices in adjacent bars shall be staggered as directed by the Engineer-in- Charge. Lap length of bars

shall be as shown on the drawings and as per Indian Standards. This length may be changed by the Engineer-in-Charge in special locations.

iii) If the contractor proposes to use welded splices in the reinforcing bars, the equipment, the materials and all welding and testing procedures shall be subject to the approval of the Engineer-in-Charge. The contractor shall carry out test welds as required by Engineer-in-Charge.

iv) For welded splices for reinforcing bars, welding shall be done in accordance with relevant Indian Standard Codes. Electrodes for welding shall conform to relevant Indian Standards. But welding shall be done only to reinforcement bars of weldable grade.

v) If the Contractor proposes to use mechanical couplings for reinforcing bars, he shall submit samples of the proposed coupling to the Engineer-in-Charge for approval prior to their proposed use.

vi) Lap splices shall not be used for bars larger than 36mm diameter, which may be welded with the approval of the Engineer-in-Charge. In cases where welding is not practicable, lapping of bars larger than 36mm may be permitted, in which case, additional spirals shall be provided around the lapped bars. Where welding is approved, the Contractor shall prepare at least three samples of butt welds as directed by the Engineer-in-Charge. These specimens shall undergo tests by the Contractor in a recognised laboratory. If the results are satisfactory, the Engineer-in-Charge may allow welding instead of lap joints. The decision of the Engineer-in-Charge in this regard shall be final. The joint shall be butt welded by the electric-arc-method. The ends of the bars shall be cleaned of all loose scale, rust, grease, or other foreign materials and all welding shall conform to the relevant Standard Specifications for welding of reinforcement bars used in reinforced concrete construction or as directed by the Engineer-in-Charge.

vii) A weld shall be considered unsatisfactory if it fails to sustain a tensile stress of at least 90% of the tensile strength of the bar in which the weld has been made.

5.2.5 Placing:

i) Before being placed in position, the reinforcing steel shall be thoroughly cleaned of loose mill scale and rust, grease, paint, or other coatings that would reduce bond. All splashed concrete, which has dried on the reinforcing steel, shall be removed.

ii) Reinforcing steel to be incorporated in the Works shall be placed accurately in positions and shall be held firmly in place during the placing and setting of the concrete.

iii) Reinforcing steel shall be so placed that there will be a clear distance of at least 50mm between the reinforcing steel and edge of concrete or embedded metal Work.

iv) Reinforcing steel shall be maintained in position by the use of small concrete blocks, steel chairs, steel spacers, steel hangers and other steel supports and ties, acceptable to the Engineer-in-Charge. at sufficiently close intervals so that they do not either sag between supports or be displaced during placing of concrete or by any operation on the Work. Wood supports or spreaders shall not be used. All intersections shall be securely tied except that where the bar spacing is less than 300 mm in each direction, only alternate intersections need be tied.

v) Binding wire and steel chairs shall not be carried to permanently exposed surfaces and shall be subject to the same requirements with regard to concrete cover as for the reinforcing steel.

vi) Special care shall be exercised to prevent any disturbances of the reinforcement in concrete that has already been placed. The reinforcement after being placed in position shall be maintained in a clean condition until it is completely embedded in concrete.

vii) The longitudinal bars shall be straight and fixed parallel to each other and to the sides of the form. The ties, links and stirrups connected to the bars shall be tightly fixed so that the bars are properly braced. The inside of

their curved part shall be in actual contact with the bars around which they are fixed and their position shall be exact.

viii) Wire for tying reinforcement shall be black annealed iron wire. The diameter of wire shall not be less than 1.6 mm and shall have an ultimate strength of 5.63 tonnes per cm_2 and yield point of not less than 3.87 tonnes per cm_2.

ix) "Bar-Grip" type joints shall be adopted by the Contractor for deformed bars of 25 mm diameter and above, subject to the approval of the Engineer-in-Charge. Splices at points of maximum stress shall however, be avoided. Splices in adjacent bars shall be staggered as directed by the Engineer-in-Charge.

x) Sufficient concrete cover shall be provided to protect reinforcement from corrosion. All protruding bars from concrete to which other bars are to be attached and which shall be exposed to action of the weather for long period shall be protected from rusting by a thin coat of neat cement grout. Accurate record shall be kept at all the times of the number, sizes, lengths and weights of bars placed in position for different parts of the Work.

xi) The Contractor shall avoid the use of two different grades of steel for one construction object.

5.2.6 Tolerance for Placing Reinforcing Steel:

i) Unless otherwise required by the Engineer-in-Charge, reinforcement shall be placed within the following tolerances:

a) For effective depth of members of 300 mm or less, the variation shall be limited for spacing of rebars +25 mm, for cover –5 mm, +2 mm,

b) For effective depth of members of more than 300 mm, the variation shall be limited for spacing of rebars +25 mm, for cover –8 mm, +2 mm.

ii) The cover shall, in no case, be reduced by more than one-third of specified cover or varied beyond the above tolerances whichever is less, unless approved by the Engineer-in-Charge.

5.2.7 Care of Placed Reinforcement and Concrete:

Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position, care shall be taken to ensure that at no time the radius of the bend is less than 8 times the diameters for deformed bars and 6 times the diameters for plain mild steel bars. Care shall also be taken, when bending back bars, to ensure that the concrete around the bar is not damaged.

5.3 BONDING AGENT:

i) The supply, application and testing of the bonding agent shall conform to relevant Indian Standards or, where not covered by Indian Standards, to their equivalent International Standards, subject to the approval by the Engineer-in-Charge.

ii) In case of conflict between the relevant Standards and the Specifications given herein, the decision of Engineer-in-Charge should prevail.

5.3.1 Material:

The material to be used is SBR (Styrene Butadiene Rubber) Polymer modified cementitious bond coat applied @

10% of cement weight. The application shall be done @ 2.2 kg of cement mixed with suitable proportion of approved polymer per sqm of surface area. The application of the said material is to be carried out after

totally saturating the cleaned concrete surface with clean water for proper bonding.

5.3.2 Applications:

The material shall be supplied by reputed manufacturer and the application/ treatment to be carried out on the concrete surfaces as per the manufacture's specification.

5.4 REPAIRING OF EXISTING DAMAGED CONCRETE:

5.4.1 Material:

Epoxy Grout:

The prepared Epoxy Grout meant for application should be solvent free, fast curing & water insensitive, suitable for damp concrete, which can be filled into lift joints/ shutter joints, cracks or any other damaged locations of concrete for structural repairs. Typical properties of Epoxy resin are listed below:

Compressive strength 100 N/mm$_2$	Compressive strength 100 N/mm$_2$
Tensile strength 43 N/mm$_2$	Tensile strength 43 N/mm$_2$
Flexural strength 75 N/mm$_2$	Flexural strength 75 N/mm$_2$
Adhesive strength 15 N/mm$_2$	Adhesive strength 15 N/mm$_2$

Water absorption should be approximately 0.2% or less and shrinkage by volume should be 0.01% or less. The Epoxy resins, in general, should have resistance to acids, alkalis and organic chemicals.

Non- Shrink Cementitious Grout:

The Grout mix shall be stirrer mixed Acrylic Polymer of approved make @ 2% of weight of cement used modified cement slurry mixed with non-shrink compound. The grout shall meet the requirement of ASTM C 1107 Grade C, when prepared according to manufacturer's instruction and tested at 4$_o$C and 32$_o$C.

Non-shrink cement-based grout must have a full range of consistencies, including dry pack, plastic and flowable state, to be suitable for use in a variety of applications. Grout should be capable of being pumped flowable without segregation. Vibration only when expressly stated by manufacturer. Grout working time shall be minimum of 60 minutes regardless of application consistency used. The grout shall contain no metallic substances (catalysed or non-catalysed), aluminium powder, water reducing agents, fluidifies, accelerators, super plasticizers, or other materials known to increase drying shrinkage and/ or compromise long-term durability.

Non-shrink cement-based grout shall have a minimum compressive strength of 50N/mm$_2$ at 7 days, as determined by test on 50 mm cubes per ASTM-C109. All non-shrink grouts shall consist of only pre-measured,

pre-packaged materials supplied by the grout manufacturer, except water. Mixing and pouring of ordinary cement shall be performed at ambient temperature of over 5$_o$C. Grout types shall be mixed according to

manufacturer's recommended procedures. The amount of water added to a non-shrink cement-based grout shall not exceed the manufacturer's maximum recommended water content to determine its consistency. The lowest water/grout ratio needed to get the grout in place should be used. Mix the cementitious grout for 3 to 5 minutes for uniform consistency.

5.4.2 Application:

Epoxy Grout:

All visible cracks should be cleaned by removing the loose concrete and sealed with Epoxy Mortar before doing Epoxy grouting. Complete application methodology is briefed in the following steps:

- Mapping of cracks in grid pattern.
- Cleaning of cracks, honeycomb, rough concrete area, etc. with wire brush, high pressure jet, needle hammer, etc.
- Drilling of holes of 16mm dia and at least 30cm deep to fix up the nipples/ nozzles.
- Fixing of nipples/ nozzles in drilled holes.
- Internal flushing of cracks with low pressure water.
- Injection of selected Epoxy grout into cracks through grout nipples from one nipple to the next. On overflow of Epoxy in the adjacent hole, the hole to be closed and continue the injection in the next hole.

Non-Shrink Cementitious Grout:

- Grout placement shall proceed in a manner that assures the filling of all voids and the intimate contact of grouting materials with surfaces to be grouted. The placement of grout shall be rapid and continuous so as to avoid cold joints under any base plate. For open frame-type skid equipment, grouting mortar shall be poured up to the top level of the skid to prevent rain water from accumulating in the skid.
- All grouting shall be done in one direction only, placing grout on one side and working it to the other to avoid trapping air. Placement will be such as to provide full and uniform bearing under all foundation bearing surfaces. Re-tempering of grout by adding more water after stiffening is not permitted.
- Hydrostatic head pressure shall be maintained keeping the level of the grout in the head box above the bottom of the base plate. The head box shall be filled to the maximum level and the grout worked down to top of base plate. All exposed grout shall be provided with a 25 mm, chamfer, unless otherwise directed by purchaser's Engineer-in charge. The final level of the grout shall be as installed with all chamfer edges built into the formwork.

5.5 DOUBLE SCAFFOLDING SYSTEM:

The double scaffolding system shall be of cup lock type arrangement made with 40mm dia M. S. Tubes @ 1.5m centre-to-centre spacing in both ways and fixed with cup lock arrangements. The entire system shall comprises of M. S. Tubes, M. S. Tube Challies, M. S. Clamps and M. S. Staircase System in the scaffolding for working platform, etc. the scaffolding system shall be stiffened with bracings, runners, connection with the building, etc., wherever required.

5.6 MISCELLANEOUS WORKS:

5.6.1 Cleaning of Reinforcement Bars:

The scope of the work is cleaning of reinforcement bars from rust so as to give a total rust free steel surface. The rust removal compound shall be alkali based chemical conforming to IS: 9077. The selected chemical shall be such that there won't be any reaction with the Steel Reinforcement or the sound surrounding concrete. The entire operation shall be carried out as per manufacturer's guidelines and with properly trained worker.

5.6.2 Supply & Application of Corrosion Protective Coatings:

The scope of the work is supply and application of 2 (two) coats of Zinc rich anticorrosive protective coating (Nitozinc Primer of Fosroc or equivalent) on properly cleaned & prepared steel reinforcement. The steel reinforcement shall be cleaned totally free from rust with application of suitable alkali based chemical.
The coverage of the anti-corrosive protective coating shall be around 0.2 Ltr per Sqm. The Coating shall conform to IS: 9172. The material shall be non-reactive to the concrete & steel.

5.6.3 Supply & Application of SBR Polymer Modified cement Mortar:

The scope of the work includes supply & application of SBR (Styrene Butadiene Rubber) modified Cement Mortar in areas indicated in the Construction drawings or as directed by the Engineer-in-Charge. The mixing shall be done in 1:4 ratio (1 cement: 4 graded coarse sand mixed with suitable SBR polymer @ minimum 2% by weight of cement used) as per manufacturer's specification. Suitable SBR Polymer in approved proportion shall be added in cement/cement mortar as per manufacturer's guidelines. Mixing shall be done preferable manually. If concrete mixer is used, proper care shall be taken regarding achievement of desired consistency. Application of the modified mortar shall be done in layer of thickness 12-15mm.

5.6.4 Cleaning of exposed concrete surface:

The scope of the instant work is cleaning of exposed concrete surface from pallets of damaged concrete/ plaster, removal of sticking materials including loose concrete, plaster or foreign materials by sand blasting with coarse sand followed by or including cleaning with oil free air blasting complete in all respect as per relevant standards or as directed by the Engineer-in-Charge.
The procedure for sand blasting with coarse sand shall conform to the stipulations of "Abrasive Blasting Code of Practice 2021". The surface cleaned with sand blasting with coarse sand shall be further cleaned with oil free air blasting.

5.6.5 Plastering Works:

i) This specification covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of plastering and allied finishes to masonry and concrete. This shall also include the work to be done to make surfaces suitable for receiving the finishing treatment and any further finishing

treatment over base finishing treatment. Before commencing work on the finishing items the Contractor shall obtain the approval of the Engineer-in-Charge regarding the scheduling of work to minimise damage by other

contractors. He shall also undertake normal precautions to prevent damage or disfiguration to work of other contractors and other installations.

ii)Mortar for plastering shall be as specified in the specification and in the Schedule of Items. For sand cement plaster, sand and cement in the specified proportion shall be mixed dry on watertight platform and minimum water added to achieve working consistency. No plaster, which has stood for more than half an hour shall be used; plaster that shows tendency to become dry before this time shall have water added to it. The mortar shall be dashed on the prepared surface with a trowel and finished smooth by trowelling on the surface. The standard of finish expected is high and shall conform to IS: 2394. Plastering works shall be carried out on the areas as shown in the drawing or as directed by Engineer-in-Charge. Plastering shall commence at top and work downwards.

5.6.6 Supply & Application of Anti-carbonation Protective Coating:

The scope of the work includes supply & application of high performance Anti-carbonation Protective Coating "***Deckguard E2000 of Fosroc/ Masterseal 878 of BASF***" or equivalent on the surfaces as directed by the Engineer-in-Charge. Application shall be done using airless spray or roller at right angle to tach other with a coverage of 5 sqm per litre per coat. The coating thickness shall be 200 micron WFT or 100 micron DFT. Minimum intercoat period shall be 12 hours at application temperature $35^{o}C$. Overall the total thickness of 2 (two) layers shall be 200 microns DFT & coverage of 2.5 sqm per litre.

The coating system shall conform to stipulations of BS EN 1504-2. The coating system shall be single component, crack accommodating, elastomeric coating suitable for application by brush, roller or spray. The protective coating system should have CO_2 diffusion resistance not less than 240mm equivalent of air thickness and 60cm equivalent of 30N Concrete along with a water vapour transition resistance of less than 1.0m. the coating should have static crack accommodation of not less than 2mm and adhesion greater than $1N/mm^2$ as per BS 1881. The primed surface shall be allowed to dry completely. Under no circumstances, anti carbonation coating shall be applied on wet surface. All primed substrates should be treated with one coat of the anti-carbonation coating. It is important that no gaps or 'raw edges' appear in the finished coating. Special care should be taken to provide an unbroken coating at external corners and similar exposed protrusions. This should be applied to all areas by the use of suitable brushes or rollers or spray to achieve a uniform coating with a WFT not less than 200 microns. Alter application, it should be allowed to dry until firm to the touch.

5.6.7 Painting Works:

This specification covers painting of both interior and exterior surfaces of masonry, concrete, plaster, structural and other miscellaneous steel items, external surface of over ground water pipes, rain water down comer, etc. as shown on drawings or as directed by the Engineer-in- Charge.

Materials shall be highest grade products of well-known approved manufacturer and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name and colour shade, with labels intact and seal unbroken. All materials shall be subject to inspection and approval by the Engineer-in-Charge. It is desired that the materials of one manufacturer only shall be used as far as possible and paint of particular shade be obtained from the single batch. All paints shall be subjected to analysis from random samples taken at site from painter's bucket, if so desired by the Engineer-in-Charge. All prime coats shall be compatible to the material of the surface to be finished as well as to the finishing coats to be applied.

All unspecified materials such as turpentine or linseed oil shall be of the highest quality available and shall conform to the latest IS Standards. All such materials shall be made by reputed and recognised manufacturers and shall be approved by the Engineer-in-Charge. All colours shall be as per painting/finish schedule and tinting and matching shall be done to the satisfaction of the Engineer-in-Charge. In such cases, where samples are required, they shall be executed in advance with the specified materials for the approval of the Engineer-in-Charge.

Synthetic Enamel Paint shall be made from synthetic resins and drying oil with rutile titanium dioxide and other selected pigments to give smooth, hard, durable and glossy finish to all exterior and interior surfaces. White and pastel shades shall resist yellowing and darkening with ageing. The paint shall conform to IS: 2932 (Latest Revision) and IS: 2933 (Latest Revision). Multi Surface paint shall be made from water-based acrylic copolymer emulsion with rutile titanium dioxide with excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, should be able to withstand washing with mild soap and water without any deterioration in colour or without showing flaking, blistering or peeling, etc. The paint shall be applied on walls in 2 (two) layers @ 1.25 ltr per 10 sqm of area over 1 (one) coat of special primer @ 0.75 ltr @ 10 sqm of area.

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6.0. Control of non-conformities:

Non-conforming products and executed works shall require following types of dispositionaction:

a) Acceptance for repair or rework:

In case of acceptance with repair or modification or rework, approval of repair/modification or rework process shall be obtained from the EIC. Inspection for acceptance after repair / modification or rework shall also be ensured.

b) Rejection:

It shall be ensured that rejected material / works do not find way back for acceptance. It shall be suitably segregated and disposed of.

c) Preventive action:

In course of reviewing non-conforming product / work, the cause of incident and situation leading to it are usually revealed. Corrective action which is necessary to eliminate to avoid recurrence shall be taken.

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7.0 Format for Contractor's Field Quality Assurance Plan (FQAP) :

Contractor's Logo		Contractor's name & address	Field Quality Assurance Plan (FQAP) Item of works :					**Project name**: Repairing and Renovation work of Cooling Tower in the Plant Area of AGBPS, NEEPCO Ltd, Bokuloni Dist.-Dibrugarh, Assam	
Sl.No.	Activities	Characteristics	Class of check	Type of check	Quantum of check	Reference Document	Acceptance norms	Format of records	Remarks
1	2	3	4	5	6	7	8	9	10

Guidelines :

1. **Column 1** : Serial number.
2. **Column 2** : Item of work / material in detail including exact area and stage of processing, testing, etc.
3. **Column 3** : Characteristics of checks like , physical, visual, dimensional, hydraulic, chemical, mechanical, performance, ultrasonic etc.
4. **Column 4** : Class shall be classified as critical (A), major(B) and minor(C). [**Critical class (A)** : Checks for defects those are deemed to be hazardous or totally unsafe. **Major class (B)** : Checks for defects those are likely to create failure of the component / structural unit for its intended purpose. **Minor class (C)** : Checks for defects those are discrepancies from the acceptable standards but are not likely to affect the usability of the component / structural unit.]

Classification of checks	**Checking Authority**	**Accepting Authority**
Critical (A)	NEEPCO & Contractor + FQA	Project Authority / EIC
Major (B)	NEEPCO & Contractor	NEEPCO-Project Authority.
Minor (C)	Contractor	NEEPCO- Engineer-In-Charge.

5. **Column 5 :** Type of check shall indicate nature of check i.e. visual, measurement, physical, chemical analysis, Non Destructive Test etc.
6. **Column 6 :** Quantum of check shall be 100% for all characteristics preferably unless otherwise mentioned in reference documents. In case of non-conformity,accepting authority shall ensure & approve disposition before accepting and the disposition shall have to be reflected in Log-sheets / protocols.
7. **Column 7 :** Reference standard / drawing / technical specification etc. as per which checks / tests to be carried out shall be indicated.
8. **Column 8 :** Acceptance norms like plant standard, design data, standard/s etc shall be indicated.
9. **Column 9 :** Appropriate format/s or certificate on which test/ inspection results to be recorded shall be indicated.
10. **Column 10:** Any specific remark/s shall be written here in this column.