Section V

TECHNICAL SPECIFICATIONS

Scope of the work: -

The scope of this work is to supply Foundation Chemical, Anchors bolts, carry out Core drilling of foundation holes of required size and depth in concrete floor as per the layout drawing and anchoring the foundation bolt using chemical anchoring grout with proper fixtures to achieve the required position tolerances. The entire work has to be carried out at in BARC, Mysuru site. Details of the work are as follows:

1 Supply, Inspection, Manufacturing and Testing of Foundation bolts of High Tensile Steel (zinc coated) full length threading with two hexagonal nuts and washer as per IS 1367.

1.1 The contractor shall supply full quantity of foundation anchor Bolts.
1.2 Material of Anchor Bolt: High Tensile Steel (zinc coated) as per IS 1367 (part 3) Property Class 10.9
1.3 Size of anchor: M20 X 270 mm long, Pitch is 2.5 mm.
1.4 Anchor end: One end shall be chisel point and other end with chamfer
1.5 Material of nut: High tensile steel, as per IS 1367 (part 6) Property class 10
1.6 Coating: Zinc electroplated to thickness of minimum 5 microns and as per IS 1367 part 11 and shall be subjected to corrosion test (salt spray test) as per IS 1367 part 11.
1.7 The zinc coating shall continue to adhere to the base metal when subjected to the burnishing test specified in ISO 2819. The chromate coatings (hexavalent or others) shall be tested for adhesion in accordance with ISO 3613. All tests, including accelerated corrosion testing, shall be carried out at least 24 h after chromate conversion treatment.
1.8 When tested in accordance with the neutral salt spray (NSS) test specified in ASTM B117 for the times specified in ISO 2081, the test surface shall remain free from red corrosion products and from white corrosion products when examined by the unaided eye or corrected vision.
1.9 The limits for surface discontinuities on bolts and Nuts shall be as per ISO 6157.
1.10 The Bolts and Nuts shall be clearly finished, sound & free from defects which may affect their serviceability, and shall be consistent with the grade prescribed.
1.11 The packing of fasteners shall conform with IS 1367 Part 18 Industrial Fasteners - Threaded Steel Fasteners -- Technical Supply Conditions
1.12 Necessary test certificates for the above-mentioned bolt/Nut specifications both for material composition and mechanical strength from NABL approved laboratories to be submitted along with the bulk supply once the contract is awarded.

2 Site Cleaning, Marking, Manufacturing of fixtures, templates and Diamond Core Drilling of foundation holes of dia: 25mm to a depth of 200 mm using diamond core drilling machine over concrete flooring.

2.1 Complete anchor hole drilling shall be carried out using Diamond core drilling machine.
2.2 The foundation holes are to be drilled as per the layout locations shown in drawing.

2.3 The site shall be cleaned and the required marking as per drawing shall be carried out by the contactor on the exact location.
2.4 Necessary template for marking shall be fabricated by the party for marking purpose.
2.5 Type of flooring: The flooring to be drilled is made up of Ironite 40mm thick (equal to RCC grade) followed by 150mm thick RCC and 75mm PCC. The RCC is of grade M20 with reinforcement rods of size 8-10 mm.
2.6 Drilling of foundation holes of suitable size for chemical anchoring as per the chemical grout requirement (˜dia 25mm) having a minimum depth of 200 mm using diamond core drilling machine shall be carried out.
2.7 Necessary clamping arrangements/Anchor bolts required to mount diamond core drilling machine have to be arranged by the contractor.
2.8 Drilling work shall be started only after markings inspected and approved by BARC representative.
2.9 Cleaning of the drilled hole: Proper cleaning of the drilled hole as per the chemical grout manufacturer's instruction shall be carried out. This involves hole cleaning by blower and brush for better bonding

3 Supply, Inspection, Testing and Chemical grouting of foundation bolts using high quality styrene free resins with fast curing low odor system for withstanding a pull-out test of 5.5 tons

3.1 Chemical grout: It shall be styrene free rapid curing low odor two component based high quality chemical mortar. Dispenser with appropriate mixer nozzle for properly filling the hole shall be in the scope of contractor.
3.2 Chemical grout to be used shall be of high quality and shall withstand a pull-out test of minimum 5.5 tons. The chemical grout used shall have adequate gel time and curing time.
3.3 The contractor shall submit the complete technical details of chemical grout and shall get it approved by BARC Representative before initiating the work.
3.4 Fixture: It is the responsibility of the contractor to make suitable fixtures to maintain the center distances of the bolts before grouting. The center distances in the actual support (where these grouted bolts are to be located) are within ± 0.2mm with a radial bolt hole clearance of 2.5mm. Fixtures are to be made to meet this requirement. Total thread length of each foundation anchor to be projected out of floor level is 80mm.
3.5 The chemical grout used shall be high performance and rapid curing type.
3.6 It shall be styrene free low odor two component based chemical mortar.
3.7 It shall be nonflammable.
3.8 It shall have high load bearing capacity in concrete and masonry for medium to heavy duty applications.
3.9 It shall not impart any expansion stresses on the base material
3.10 It shall be vibration resistant and corrosion resistant
3.11 It shall be based on high reactivity unsaturated resins monomers.
3.12 It shall have appropriate gel time and curing time values for suitable use in carrying out large number of anchoring.
3.13 Adhesives shall be injectable, cartridge-type based system, dispensed and mixed through a static mixing nozzle supplied by the manufacturer.
3.14 Acceptable installation procedure and performance temperature ranges along with manufacturer's literature shall be submitted prior to installation.
3.15 If fillers are used it shall be inert, shall be incorporated uniformly in one or both components. The filler shall be either non settling or readily dispersible in any component in which it is incorporated.

3.16 The adhesive used shall be capable to cure under humid conditions and bond to damp surfaces.

3.17 The chemical mortar used shall have following typical properties specified in below mentioned Table.

Sl. no	Property	Unit	Value
1.	Gel Time (100g at 20^{o}C)	min	5-30
2.	Full curing time in dry base material	min	30-600
3.	Bond strength (minimum)	MPa	7
4.	Absorption 24h (max)	%	1.0
5.	Heat Deflection temperature (min)	^{o}C	50
6.	Linear coefficient of Shrinkage on cure (24hrs)	%	0.5
7.	Compressive Yield strength (minimum)	MPa	60
8.	Compressive Modulus (minimum)	MPa	1400
9.	Elongation at break	%	0.5-1
10.	Storage temperature range	^{0}C	5 to 35
11.	Shelf life (minimum)	months	6

4 Applicable Documents:

4.1 **Drawing**: Typical layout drawing for Diamond core drilling is shown in A4-MD-165 R1. Detailed drawing shall be reveled in Prebid queries on request by bidders. The drawing shall be issued to successful bidder for commencement of work.

4.2 IS 1367-Technical Supply Conditions for Threaded Steel Fasteners

4.3 IS 1367- Part-3 Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel — Bolts, Screws and Bolts

4.4 IS 1367- Part 6 Mechanical Properties and Test Methods for Nuts

4.5 IS 1367- Part 11 Threaded Steel Fasteners- Electroplated Coatings

4.6 ASTM E 488 Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

4.7 ASTM E 4 - Practices for Force Verification of Testing Machines

4.8 ASTM E 74 - Practice for calibration of force measuring instruments for verifying the force indication of testing machines

4.9 ISO 2081:1986 - Metallic coatings — Electroplated coatings of zinc on iron or steel.

4.10 IS 2770 - Methods of Testing Bond in Reinforced Concrete

4.11 IS 11309 - Method for Conducting Pull-Out Test on Anchor Bars and Rock Bolts

4.12 IS-2102 (Part 1 and 2) - General Tolerances for Dimensions, Forms and Position.

The latest issues of the documents listed above constitute a Part of this specification to the extent specified herein. In the event of certain requirements of the specification, drawing or data listed above creates conflict, the decision will be at the discretion of the BARC.

5 Testing And Acceptance Criteria

5.1 **Sample testing before bulk supply**: Random sample of Anchor bolts will be tested for checking its properties before bulk supply. The bulk supply can be executed after acceptance of sample testing. The testing procedures and acceptance criteria is mentioned below in detail.

5.2 Pull out test: Contractor should carry out pull out test after chemical grouting to ensure proper bonding of chemical grout for 50 numbers.

- The 50 number of grouting bolts shall be done specifically for destructive pull-out testing. The grouted bolts which are qualified in the pull out testing will be included in executed work quantity for payment by BARC.
- The testing location will be identified and conveyed by BARC Representative in proximity to actual anchoring locations.
- The bolt should withstand a pull-out test of minimum 5.5 tons load. In the event of more than 10% failures, the actual locations (1% of total) will be subjected to pull out test (5.5 tons load) at random.
- In the event of more than 10% failures of actual locations as well, further 1% of actual locations will be subjected to pull out test (5.5 tons load) at random. This process will continue till the failure is less than or equal to 10%.
- In the event of less than or equal to 10% failures among the destructive pull out testing samples, actual locations are still liable for pull-out test (5.5 tons load) asper the discretion of BARC.

5.3 The bolt should withstand a pull-out test of minimum 5.5 tons load. In the event of failure, the bolt to be re grouted and certified for another pullout test.

5.4 The grouted bolts, which do not qualify the pull out test, will not be included for payment by BARC.

5.5 The anchor stud and nut supplied shall be complying with IS 1367 property class 10.9 and 10 respectively. Relevant test reports for mechanical properties and chemical composition complying with relevant standards shall be submitted.

5.6 The load testing shall be carried out as per ASTM E-488 standard Test methods for strength of anchors in concrete and masonry elements.

5.7 Before delivery of the materials a copy of the manufacturer's Technical Data Sheet, attesting that material meet the requirements specified, shall be submitted to and approved by EIC as an alternate proof of performance. The contractor shall submit all the required Test Certificates as per relevant standards procedures complying with the specifications. Final acceptance shall be decided based on the reports and results obtained in field tests after completion of work.

5.8 Chemical adhesives shall be allowed to gain strength for the minimum time specified by the manufacturer's usage instructions before torque is applied to bolts and load is applied to the bonded anchor system.

5.9 Only Calibrated electronic load and displacement measuring devices, calibrated in accordance with 'ASTM E4 Practices for Force Verification' shall only be used. The equipment used shall be capable of measuring the forces with an accuracy of ± 1 % of the anticipated ultimate load.

5.10 Tested bonded anchors shall be installed by suitably competent and experienced personnel, and in accordance with the requirements of drawing, in positions that are representative of the positions of the bonded anchors as required by the design.

5.11 Testing shall be conducted by a competent person who has experience in testing of bonded anchors and test reporting.

5.12 Bonded anchors shall be tested using testing equipment that has been calibrated as a minimum, on an annual basis at the required intervals in accordance with ASTM E 74. One week prior to testing the Contractor shall submit to the EIC calibration certificates conforming to the requirements of relevant standards for the jack and pressure gauges or other force measuring devices to be used.

5.13 The measuring equipment shall allow the applied force to be determined to an accuracy of ± 2%. If measurement of displacement is required, the measuring equipment shall

comply with AS 1391 and shall allow elongation to be determined with an accuracy of ± 0.02 mm, with measurements made directly on the anchor.

5.14 Arrangement of all the necessary test instruments, preparation of set up, sample preparations etc. required for qualifications of the pull-out tests are in the scope of contractor.

5.15 The Contractor has to submit Quality Assurance Plan (QAP) before commencement of work and get it approved from BARC Representative.

6 Precautions to be followed while executing the work

6.1 Diamond core drilling shall be carried out using diamond drill bits of appropriate size to make a hole of suitable size and depth as required by specifications and blow out dust with air.

6.2 Brush the hole with an appropriately sized wire brush with stiff nylon or wire bristles, a minimum of 3-4 times in a twisting motion. If the bore hole ground is not reached with the brush, appropriate extension must be used.

6.3 Blow out the dust again with clean air. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) a minimum of 3-4 times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.

6.4 After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

6.5 Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent colour.

6.6 The chemical adhesive shall be used within the time limit (working time or gel time) stated in the manufacturer's installation requirements. If a working interruption is longer than the recommended working time as well as for new cartridges, a new static-mixer shall be used.

6.7 Care must be taken while withdrawing static mixing nozzle so as to avoid creating air pockets. If the bore hole ground is not reached with the static-mixing nozzle, appropriate mixer nozzle extensions shall be used.

6.8 Each hole shall be checked visually to ensure that the chemical adhesive is injected to the correct depth (typically 2/3 of the hole depth) prior to insertion of the metal anchor rod.

6.9 Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.

6.10 While pushing the threaded rod or reinforcing into the anchor hole positive distribution of the adhesive shall be ensured by turning it slightly until the embedment depth is reached. The anchor should be free of dirt, grease, oil or other foreign material.

6.11 If a popping or cracking sound is heard while inserting the anchor rod, air voids are present in the chemical adhesive. in such a case remove the anchor rod, allow the chemical adhesive to fully harden, re drill the hole and repeat the entire installation process.

6.12 Excessive chemical adhesive shall be removed from the concrete and anchor rod surfaces after inserting the anchor rod.

6.13 Ensure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed.

6.14 Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured.
6.15 The entire procedure for placing chemical adhesives and anchor rods shall be in accordance with the manufacturer's installation requirements.

7 General Instructions and Conditions

7.1 Disposal of concrete debris after drilling asper BARC norms is responsibility of Contractor.
7.2 All the tools / equipment/ fixtures required for this work shall be within the scope of contractor.
7.3 The entire work shall be inspected and certified by the department staff during its course of execution.
7.4 Strict discipline, all safety rules and security guidelines shall be followed while working at BARC site.
7.5 Necessary safety items such as gloves, goggles etc shall be within the scope of contractor.
7.6 The contractor shall obtain necessary safety clearance from Safety section of BARC, Mysuru before commencement of the work.
7.7 The contractor shall provide for proper packing of the bolts and chemical resins as required for preventing any type of damage or deterioration during their transit as well as its storage time in BARC, during the course of execution of this contract.
7.8 Inspection: Departmental Engineer will inspect every stage of Work and one departmental Supervisor will be available in field for monitoring the progress as well as for technical supervision. Any corrections required after inspection shall be carried out by the contractor.
7.9 The contractor should submit a detailed scheduling of activities to be followed for executing this contract before commencing the work.
7.10 Cleanliness: Keeping the area clean and tidy is of utmost importance. All the waste like used tissue papers, cotton waste, etc. shall be put in the waste material drums kept in the area. Under no circumstances, the waste shall be littered on the floor of the working area or the surroundings.
7.11 The contractor has to deploy required number of manpower, whenever requirement arises and as per the instruction from BARC representative. Conveyance (transportation) of all deputed personnel shall be at the contractor's cost.
7.12 The area where the work has to be carried out fall under region of category and hence special care and vigilance shall be maintained throughout while working therein.
7.13 The contract personnel shall work only under the supervision and guidance of department personnel.
7.14 Safety Precautions: The contractor shall carry out the works in compliance with prevailing safety regulations of BARC. The contractor should take care the safety of the equipment and components during the execution of works at site.

The contractor shall submit a detailed Quality Assurance Plan for carrying out this job in compliance with our requirements. The same shall be submitted and get it approved by BARC representative, before commencement of any work.

Section VI
Drawing