

S.05: REINFORCEMENT**5.1 General**

These specifications shall be read in conjunction with the CPWD specifications 2019 with upto date correction slips, MOST/MORTH Specifications and other relevant specifications described in the S.01 of Section-VII-F of these specifications.

High strength deformed steel bars for concrete reinforcement used in the works shall be Fe 500D TMT or higher grade, conforming to IS 1786. Steel specified for reinforcement shall conform in every respect to the latest relevant Indian Standard Specifications and shall be of tested quality under the ISI Certification Scheme.

All reinforcement work shall be executed in conformity with the drawings supplied and instructions given by the Engineer and shall generally be carried out in accordance with the relevant Indian Standard Specifications IS: 2502 Bending and Fixing of Bars for Concrete Reinforcement.

The reinforcement steel shall be from primary producers from the approved vendor list and no re-rolled steel shall be supplied/used. The Contractor shall produce copy of original challan or voucher as a proof of having purchased the steel reinforcement from manufacturers or their authorised distributors having approval of the Engineer.

Procurement of reinforcement steel shall be so phased by the Contractor that the storage period before its actual use in the works is limited to the bare minimum as directed by the Engineer.

In order to offer adequate resistance against corrosion, reinforcement bars shall be provided with a coating of " Truncated Inhibited Cement Slurry (Patent No. 109784/67 of CECRI, Karaikudi)" for non-aggressive environments (Mild and Moderate). **No extra payment shall be made for the same.**

5.2 Inspection & Testing:

Manufacturer's test certificate steel shall be submitted for each lot of supply brought at Site of work by the Contractor. The reinforcement shall be tested as per IS 1786-2008. However, the sampling of the same shall be as laid down in the CPWD specification 2019 with latest correction slips. The cost of the same is deemed to be included in the contract price and nothing extra shall be payable to the contractor in this regard. Every bar shall be inspected before assembling on the works and any defective, brittle, excessively rusted or burnt bars shall be removed. Cracked ends of bars shall be cut out.

Batches shall be rejected if the results of each batch are not in accordance with the specifications.

Every consignment of steel brought to the site of works for use in reinforced concrete work, shall be accompanied by a certificate from the manufacturer giving the following details:

- a) Place of manufacture of the reinforcing steel,
- b) Nominal diameter of the steel,
- c) Grade of the steel,
- d) Rolled-in marking on the steel,
- e) Cast/heat number,

- f) Date of testing,
- g) Mass of the tested lot, and
- h) Individual test results for all the properties,

All such certificates shall be deposited with the Engineer- in -Charge for his record and reference.

5.3 Bar bending and Bar Bending Schedule:

All bars will be carefully and accurately bent by approved means in accordance with IS: 2502, and relevant drawings. It shall be ensured that depth of crank is correct as per the bar cutting and bending schedule and bent bars are not straightened for use in any manner that will injure the material.

Prior to starting bar bending work, the Contractor shall prepare bar bending schedule from the structural drawings supplied to him and get the same approved by Engineer. No work shall commence before the approval of Engineer for the same. Any discrepancies and inaccuracies found by the Contractor in the drawings shall be immediately reported to the Engineer whose interpretation and decision there to, shall be accepted.

5.4 Lapping & Welding:/Mechanical Splicing

As far as possible, bars of the maximum length available shall be used. Laps shown on drawings or otherwise specified by the Engineer will be based on the use by the Contractor of bars of maximum length. In case the Contractor wishes to use shorter bars, laps/couplers (approved make with permission of the Client) shall be provided in the manner and at the locations approved by the Engineer. **No extra payment shall be made for reinforcement lapping.** In case the Contractor wishes to use shorter bars, laps shall be provided at the Contractor's cost in the manner and at the locations approved by the Engineer. Use of Mechanical couplers for splicing is not permitted. However, under exceptional cases, it may be allowed with the prior approval of Engineer-in-Charge purely on case-to-case basis **and no extra payment shall be made for the same.**

Welding in lieu of lap is not permitted unless specified in the drawings or as instructed by the Engineer.

5.5 Spacing, Supporting and Cleaning:

- i. All reinforcement shall be placed and maintained in the positions shown on the drawings to be prepared by contractor.
- ii. The Contractor shall provide approved types of supports for maintaining the bars in position and ensuring required spacing and correct cover of concrete to the reinforcement as specified on the drawings. Cover blocks of required shape and size, chairs and spacer bars shall be used to ensure accurate positioning of reinforcement. Cover blocks shall be cast well in advance and shall consist of approved proprietary pre-packaged free flowing mortars (Conbextra HF of Fosroc or equivalent). They shall be circular in shape for side cover and square for bottom cover. The cost of **cover blocks and Chairs / spacer bars** shall be deemed to have been included in the rates/contract price.
- iii. Bars must be cleaned, before concreting commences, of all scale, rust or partially set concrete which may have been deposited there during placing of previous lift of concrete. Any reinforcement which is certified as corroded by the Engineer shall be removed from the site.
- iv. 18 gauge G.I. wire shall be used for binding reinforcement as well as for tying cover blocks with reinforcement. **The cost of gauge wire is deemed to have been included in the rate quoted by the contractor.**

5.6 Welding (If specific approval from Engineer is granted):

- i. Wherever specified all lap and butt welding of bars shall be carried in accordance with IS: 2751. Only qualified welders duly tested and certified shall be permitted to carry out such welding.
- ii. For cold twisted reinforcement, welding operations must be controlled to prevent a supply of large amounts of heat larger than that can be dissipated. The extreme non-twisted end portion shall be cut off before welding. Electrodes with rutile coating should be used.
- iii. Bars shall be free from rust at the joints to be welded.
- iv. Slag produced in welding after alternative run should be chipped and removed by brush.
- v. Electrode should not be lighted by touching the hot bar.
- vi. The welding procedure shall be approved by the Engineer and tests shall be made to prove the soundness of the welded connection.
- vii. E7018 electrode shall be used for Fe415 grade and E8018 electrode shall be used for Fe500D and above as per AWS (American Welding Society) standards.

5.7 Measurement:

- i. The measurement shall be done by weight in MT based on bar bending schedule. Payment of reinforcement steel shall be made for the length of the reinforcement bars of different diameter as per approved bending schedule (to be prepared by the contractor on the basis of approved drawing). In case the actual reinforcement provided in any member is less than the quantity calculated based on drawings/ bar bending schedule (with the approval of engineer), the same shall be adjusted for the purpose of payment.
- ii. No additional payment will be made for any welding operations carried out on reinforcement bars and providing mechanical couplers. Laps of all types, chairs, spacers, bend correction deduction as per SP 34 etc., as required are deemed to be included in the quoted rate and nothing extra is payable on this account. **Payments shall not be made for lapping/welding and reinforcement bars used for lifting, hooks, handling, etc., as cost towards these is deemed to be included in the accepted rate of the item.**

5.8 Protective Coating of Reinforcement bars using Truncated Inhibited Cement Slurry:

The protective coating of reinforcement bars shall conform to IS 9077 and it shall be approved by the Engineer in Charge.

The reinforcement bars should be dipped in the derusting solution of approved quality and the bars removed as soon as the rust is satisfactorily removed and a bright surface is obtained. This should be immediately followed by cleaning the bars with wet waste cloth and alkaline cleaning powder.

The bars should then be brushed with the phosphate jelly of approved quality by means of fibre brush. The jelly should be left on the surface for a period of 45- 60 minutes and then removed by means of wet waste cloth. This should be followed by brushing the inhibitor solution of approved quality and the first coat of cement slurry, prepared by mixing 500 cc of inhibitor for each 1000 gm of Portland cement. All the above steps should be applied in the same day and after 12-24 hours of air-drying, the sealing solution of approved quality should be brushed followed by the second coat of cement slurry.

It should then be dried for 12-24 hours followed by a brush coat of the sealing solution which should be applied again after 4 hours of air-drying.

Briefly following steps are involved in this process:

- a) Derusting by dipping the rebars in pickling solution (patent no.465/CAL/75) for 30 minutes (pH of the solution is 1.04)

- b) Removal from acid tank and dipping in alkaline tank to neutralize and cleaning with potable water for 2 minutes.
- c) Application of phosphate jelly coat (Patent no. 109897) and drying for 45-60 minutes (pH of the jelly is 2.5).
- d) Application of inhibitor solution A (patent no. 109784/67) for 2 minutes.
- e) Application of first coat of cement slurry coating with inhibitor solution A
- f) Air drying for 24 hours.
- g) Application of first coat of sealing solution B (Patent no. 112440/67) for 2 minutes.
- h) Application of 2nd coat of cement slurry solution A for 2 minutes.
- i) Air drying for 24 hours
- j) Another coat of sealing solution B and drying for 4 hours.
- k) Application of 3rd coat of sealing solution B for 2 minutes
- l) Air drying for 4 hours.

Detailed specification regarding quality control aspects and chemicals/solutions used in the process may be obtained from Central Electro Chemical Research Institute (CECRI) Karaikudi- 623 006 (Tamandu).

No extra payment shall be made for the protective coating procedure mentioned above and cost of the same shall be deemed to be included in the contract price.