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8 **STEEL FOR REINFORCEMENT**


8.1 **SCOPE OF WORK**


- i) The Specifications described herein relate to the work which includes all labour, materials, equipment and services required for the supply, handling, storing, cutting, bending, binding, welding, cleaning, placing and fastening into position all reinforcing steel, as shown on the drawings, to be carried out by the Contractor under this Contract.
- ii) The Contractor shall produce the detailed bending schedules and placing drawings. These drawings shall be based on the outline reinforcement plans provided by the Project Manager and subject to his approval.


8.2 **SUBMITTALS**


- i) After the date of issue of the Letter of Acceptance, but before procuring the equipment, the Contractor shall submit to the Project Manager, the description and drawings showing sufficient details of the layout, type and capacity of the equipment proposed for the fabrication and bending of reinforcing steel.
- ii) Not less than 20 days prior to placement of reinforcement, the contractor shall submit to Project Manager, for approval, three prints and a representation of each of his reinforcement detail drawings. The Contractor's drawings of reinforcement details and bar list shall be prepared in accordance with IS: 456 (latest revision), IS: 2502 (latest revision) and IS: 5525 (latest revision) unless otherwise shown on the reinforcement drawings. The Contractor's drawings should show the necessary details for checking the bars during placement and for use in evaluating payment quantities. Reinforcement bars shall conform to requirements as shown on the drawings or as directed by the Project Manager. The approval of the Project Manager to the Contractor's reinforcement detail drawings shall not relieve the Contractor of his sole responsibility for the correctness of details or for correctness with the requirements of these specifications and Standards.


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<div> <div>iii)</div> <div>The Project Manager reserves the right to require any additional information deemed necessary to be included in the submitted documents.</div> </div> <div> <div>iv)</div> <div>The grade of steel used shall be indicated on each reinforcement drawing.</div> </div> <div> <div>v)</div> <div>Cutting, bending, cleaning, placing and fastening in position of the reinforcement steel shall conform to the requirements of relevant Indian Standards and as shown on the drawings.</div> </div> <div> <div>vi)</div> <div>Transportation and storage of reinforcing steel shall conform to the requirements of relevant Indian standards for properties, storage and handling.</div> </div> <div> <div>8.3</div> <div><u>STANDARDS</u></div> </div> <div> <div>i)</div> <div>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 Project Manager.</div> </div> <div> <div>IS: 280</div> <div>Mild steel wire for General Engineering purposes.</div> </div> <div> <div>IS: 432</div> <div>Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.</div> </div> <div> <div>IS: 456</div> <div>Code of practice for plain and reinforced concrete.</div> </div> <div> <div>IS: 814</div> <div>Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.</div> </div> <div> <div>IS: 1566</div> <div>Hard-drawn steel wire fabric for concrete reinforcement.</div> </div> <div> <div>IS: 1608</div> <div>Mechanical testing of metals – tensile testing.</div> </div> <div> <div>IS: 1786</div> <div>High strength deformed-steel bars and wires for concrete reinforcement.</div> </div> <div> <div>IS: 2062</div> <div>Steel for general structural purposes.</div> </div> <div> <div>IS: 2502</div> <div>Code of practice for bending and fixing of bars for concrete reinforcement.</div> </div> <div> <div>IS: 2751</div> <div>Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.</div> </div>		
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<div> <div>IS: 5525</div> <div>Recommendations for detailing of reinforcement in reinforced concrete works.</div> </div> <div> <div>IS: 9417</div> <div>Recommendations for welding cold worked bars for reinforced concrete construction.</div> </div> <div> <div>ii)</div> <div>In case of conflict between the above Standards and the Specifications given herein, the decision of Project Manager should prevail.</div> </div> <div> <div>8.4</div> <div><u>MATERIAL</u></div> <div>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).</div> </div> <div> <div>8.5</div> <div><u>FABRICATION</u></div> <div> <div>i)</div> <div>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 Project Manager.</div> </div> <div> <div>ii)</div> <div>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 Project Manager.</div> </div> <div> <div>iii)</div> <div>Reinforcing steel shall not be straightened or rebent 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.</div> </div> <div> <div>iv)</div> <div>Shorter lengths of steel shall not be used in places where continuous lengths are required as per the drawings without the approval of the Project Manager. 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 Project Manager.</div> </div> </div>		
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<div> <div>v)</div> <div>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.</div> </div> <div> <div>vi)</div> <div>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 Project Manager. 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.</div> </div> <div> <div>vii)</div> <div>Heating of reinforcement bars to facilitate bending shall not be permitted.</div> </div> <div> <div>viii)</div> <div>The reinforcement available from rejected reinforced concrete shall not be used without prior approval of the Project Manager.</div> </div> <div> <div>8.6</div> <div><u>SPLICING OF REINFORCEMENT BARS</u></div> </div> <div> <div>i)</div> <div>Wherever it is necessary to splice reinforcement, the splices shall be made by lapping, or by mechanical means.</div> </div> <div> <div>ii)</div> <div>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 Project Manager. Splices at points of maximum stress shall however, be avoided. Splices in adjacent bars shall be staggered as directed by the Project Manager. Lap length of bars shall be as shown on the drawings and as per Indian Standards. This length may be changed by the Project Manager in special locations.</div> </div> <div> <div>iii)</div> <div>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 Project Manager. The contractor shall carry out test welds as required by Project Manager.</div> </div> <div> <div>iv)</div> <div>For welded splices for reinforcing bars, welding shall be done in accordance with relevant Indian Standard Codes. Electrodes for welding shall conform to</div> </div>		
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<p>relevant Indian Standards. But welding shall be done only to reinforcement bars of weldable grade.</p> <p>v) If the Contractor proposes to use mechanical couplings for reinforcing bars, he shall submit samples of the proposed coupling to the Project Manager for approval prior to their proposed use.</p> <p>vi) Lap splices shall not be used for bars larger than 36mm diameter, which may be welded with the approval of the Project Manager. 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 Project Manager. These specimens shall undergo tests by the Contractor in a recognised laboratory. If the results are satisfactory, the Project Manager may allow welding instead of lap joints. The decision of the Project Manager 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 Project Manager.</p> <p>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.</p> <p>8.7 <u>EXECUTION</u></p> <p>8.7.1 <u>PLACING</u></p> <p>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.</p>		
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<div> <div>ii)</div> <div>Reinforcing steel to be incorporated in the Works shall be placed accurately in positions as shown on the drawings and shall be held firmly in place during the placing and setting of the concrete.</div> </div> <div> <div>iii)</div> <div>Reinforcing steel shall be so placed that there will be a clear distance of at least 50mm between the reinforcing steel and anchor bolts or embedded metal Work.</div> </div> <div> <div>iv)</div> <div>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 Project Manager 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.</div> </div> <div> <div>v)</div> <div>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.</div> </div> <div> <div>vi)</div> <div>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.</div> </div> <div> <div>vii)</div> <div>The longitudinal bars shall be straight and fixed parallel to each other and to the sides of the form as shown on the drawings. 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 as shown on the drawings.</div> </div> <div> <div>viii)</div> <div>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 cm² and yield point of not less than 3.87 tonnes per cm².</div> </div>		
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<div> <div>ix)</div> <div> <p>“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 Project Manager. Splices at points of maximum stress shall however, be avoided. Splices in adjacent bars shall be staggered as directed by the Project Manager. Lap length of bars shall be as shown on the drawings and in accordance with IS standards. This length may be changed by the Project Manager in special locations.</p> </div> </div> <div> <div>x)</div> <div> <p>Sufficient concrete cover, as indicated on the drawings 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.</p> </div> </div> <div> <div>xi)</div> <div> <p>The Contractor shall avoid the use of two different grades of steel for one construction object.</p> </div> </div> <div> <div>8.7.2</div> <div> <p><u>TOLERANCE FOR PLACING REINFORCING STEEL</u></p> </div> </div> <div> <div>i)</div> <div> <p>Unless otherwise required by the Project Manager, reinforcement shall be placed within the following tolerances:</p> <div> <div>a)</div> <div> <p>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,</p> </div> </div> <div> <div>b)</div> <div> <p>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.</p> </div> </div> </div> </div> <div> <div>ii)</div> <div> <p>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 Project Manager.</p> </div> </div>		
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8.7.3 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 diameters for deformed bars and 6 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.

8.8 MEASUREMENTS AND PAYMENTS

8.8.1 GENERAL

- i) Measurement for payment for reinforcing bars will be of the weight of reinforcement steel including hooks, bends and splices actually installed and approved by the Project Manager. Actual lengths of reinforcement bars including permissible hooks, bends and splices will be measured. The weight of reinforcing bars will then be calculated for each size of bar from the Unit weight as stated on the Certified copies of manufacturer's reports or by actual weighing at site, which the Contractor shall submit to the Project Manager.
- ii) Before starting concreting, the Contractor shall make sure that the measurements of reinforcing bars placed in position have been recorded and that the Project Manager, or his mandated representative has certified the correctness of the reinforcement used.
- iii) For the purpose of payment, a welded joint, or mechanical splicing will be considered as equivalent to a length of bar 30 times the diameter of the bar in which the weld or the mechanical splicing is made.
- iv) Payment will be made at the Unit Rate per metric tonne entered in the Bill of Quantities, which shall include the entire cost of supplying, handling, storage, cutting, bending, binding, welding, cleaning, placing, wire clips, ties, separators, mechanical connectors, and any other fastening devices.

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8.8.2 Exclusions

- i) No extra measurement for payment or payment will be made for the following:
 - a) Wire for tying reinforcement,
 - b) Any additional reinforcement or splices required when Contractors casting sequences differ from construction joints shown on the drawings,
 - c) Any reinforcing steel placed by the Contractor for his own convenience in addition to those shown on the drawings,
 - d) Devices like steel chairs, hangers, spacers, small concrete blocks, other supports, ties and anchor rods etc. used to maintain reinforcing steel in position,
 - e) Any reinforcing steel delivered for testing,
 - f) Carrying out tests for checking butt welds to replace lapping/splicing of reinforcing bars,
 - g) Any Mechanical/Welded splicing provided by the contractor due to his fault in not maintaining the required concrete cover for overlap or due to any other reason of poor workmanship as decided by the Project Manager.

End of Chapter

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