

B4: 1.0 TECHNICAL SPECIFICATIONS STRUCTURAL STEEL WORKS**12. STRUCTURAL STEEL:****12.1 SCOPE OF WORK:**

The work covered by this specification consists of furnishing and erecting of structural steel complete in strict accordance with this specifications and the applicable drawings.

12.2 MATERIALS:

12.2.1 All structural steel shall be of standard sections as marked on the drawings and shall be free of scale, blisters, laminations, cracked edges and defects of any sort. If the structural steel is not supplied by the Department and the Contractor is required to bring such steel, the Contractor shall furnish duplicate copies of all mill orders and/ or also the test report received from the mills, to satisfy the Engineer-in-Charge.

12.2.2 All structural steel and electrodes shall comply in all respects with I.S.S. for structural steel.

12.3 WORKMANSHIP:

All workmanship shall be of first class quality in every respect to the greatest accuracy being observed to ensure that all parts will fit together properly on erection.

All ends shall be cut true to planes. They must fit the abutting surfaces closely. All stiffeners shall be fit tightly at both ends.

All butt ends of compression members shall be in close contact through the area of the joints.

All holes in plates and section between 12 mm. and 20 mm. thick shall be punched to such diameter that 3 mm. of metal is left all around the hole to be cleaned out to correct size by reamer.

The base connection shall be provided as shown on drawings and the greatest accuracy of workmanship shall be ensured to provide the best connections.

Figured dimensions on the drawings shall be taken.

12.4 ERECTION AND MARKING:

Erection and fabrication shall be according to I.S. 800-1984 section-11. During erection, the work shall be securely braced and fastened temporarily to provide safety for all erection stresses etc. No permanent welding shall be done until proper alignment has been obtained.

Any parts which do not fit accurately or which are not in accordance with the drawings and specifications shall be liable to rejection and if rejected, shall be at once be made good.

Engineer-in-Charge shall have full liberty at all reasonable times to enter the contractors premises for the purpose of inspecting the work and no work shall be taken down, painted or despatched until it has been inspected and passed. The contractor shall supply free of charge all labour and tools required for testing of work.

12.5 DELIVERY AT SITE :

The contractor shall deliver the component parts of the steel work in an undamaged state at the site of the works and the Engineer-in-Charge shall be entitled to refuse acceptance of any portion which has been bent or otherwise damaged before actual delivery on work.

12.6 SHOP DRAWINGS:

The shop drawings of structural steel based on contract drawings shall be submitted to the Engineer-in-Charge. The necessary information for fabrication, erection, painting of structure etc. must be furnished immediately after acceptance of the tender.

12.7 PAINTING:

Painting should be strictly according to I.S. 1477-1971 (Part I- Pre-treatment) and I.S. 1477-1 971 (Part II-painting).

Painting should be carried out on dry surfaces free from dust, scale etc. The paint shall be approved by the Engineer-in-Charge.

One coat of shop paint (red lead) shall be applied on steel, except where it is to be encased in concrete or where surfaces are to be field welded.

12.8 WELDING:

Welding shall be in accordance with I.S. 816-1969, I.S. 819-1957, I.S. 1024-1979, I.S. 1261-1959, I.S. 1323-1982 and I.S. 9595-1980 as appropriate. For welding of any particular type of joint, welders shall give evidence of having satisfactory completed appropriate tests as described in any of I.S. 817-1966, I.S. 1393-1961, I.S. 7307 (Part-I)-1 974, I.S. 7310 (Part-I)-1974 and I.S. 7318 (Part-I)-1 974 as relevant.

12.8.1 Welding Consumables:

Covered electrodes shall conform to I.S. 814 (Part-I)-1974 and I.S.814 (Part-II)-1974 or I.S. 1395-1 982 as appropriate.

Filler rods and wires for gas welding shall conform to I.S. 1278-1972.
The bare wire electrodes for submerged arc welding shall conform to I.S. 7280-1 974. The combination of arc and flash shall satisfy the requirements of I.S. 3613-1 974.

The filler rods and bare electrodes for gas shielded metal, arc welding shall conform to I.S. 6419-1971 and I.S. 6560-1972 as appropriate.

12.8.2 Types of Welding: Arc welding (direct or alternating current) or Oxyacetylene welding may be used. Field welding may be used. Field welding shall be by D.C.

12.8.3 Size of Electrode Runs: The maximum gauge of the electrodes for welding any work and the size of run shall be based on the following tables.

Average thickness of plate or section	Maximum gauge or diameter of electrodes to be used.
Less than 3/16"	10 S.W.G.
3/16" and above but less than 5/16"	8 S.W.G.
5/16" and above but less than 3/8"	6 S.W.G.
3/8" and above but less than 5/8"	4 S.W.G.
5/8" and above but less than 1"	5/1 6" dia.
1" and above thick section	3/8" dia.

Note: On any straight weld the first run shall not ordinarily be deposited with a larger gauge electrode than No. 8 S.W.G. For subsequent runs the electrode shall not be increased by more than two electrode size between consecutive runs.

12.8.4 Welding Contractors: The contractor shall ensure that each welding operator employed on fabrication or erection is an efficient and dependable welder, who has passed qualifying tests on the types of welds which will be called upon to make. Sample test shall have to be given by the contractor to the entire satisfaction of the Engineer-in-charge.

12.8.5 Welding Procedure:

- a) Welding should be done with the structural steel in flat position in a down hand manner wherever possible. Adequate steps shall be taken to maintain the correct arc length, rate of travel, current and polarity for the type of electrode and nature of work. Welding plant capacity shall be adequate to carry out the welding procedure laid down. Adequate means of measuring the current shall

be available either as a part of the welding plant or by the provision of a portable ammeter. In checking the welding current, a tolerance of 10% or 30 amperes from the specified value whichever is less shall be permitted.

- b) The welding procedure shall be such as to ensure that the weld metal can be fully and satisfactory deposited through the length and thickness of all joints so that distortion and shrinkage stresses are reduced to the minimum and thickness of welds meet the requirements of quality specified.

12.9 WORKMANSHIP:

12.9.1 Preparation of Fusion Faces: Fusion faces shall be cut by steaming machine or gas cutting and later dressed by filing or grinding so that they shall be free from irregularities such as would interfere with the deposition of the specified size of weld to cause the defects. Fusion faces and the surrounding surfaces shall be free from heavy slag, oil paint or any substance which might affect the quality of the weld or impede the progress of welding. The welding face shall be free of rust and shall have metal shine surfaces.

The parts to be welded shall be brought into as close contact as possible and the gap due to faulty workmanship or incorrect fit up shall not exceed 1/16". If separation of 1/16" or more occurs locally, the size of the fillet weld shall be increased at such position by an amount of equal to the width of the gap.

The parts to be welded shall be maintained to their correct position during welding. They shall be securely held in position by means of tack welds, service bolts, clamps or rings before commencing welding so as to prevent and relative movement due to distortion, wind or any other cause.

12.9.2 Step Back Method Should be Used to Avoid Distortion : The minimum leg length of a fillet weld as deposited should not be less than the specified size and the throat thickness as deposited should be not less than that tabulated below:

Throat Thickness of Fillet

Angle between fusion faces	60 ⁰ -90 ⁰	91 ⁰ - 100 ⁰	101 ⁰ - 106 ⁰	107 ⁰ - 113 ⁰	114 ⁰ - 120 ⁰
Throat thickness in cms.	0.70	0.65	0.60	0.55	0.50

In no case should a concave weld be deposited without the specific approval of the Engineer-in-Charge unless the leg length is increased above the specified length so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat.

All welds shall be deposited in a pre-arranged order and sequence taking due account of the effects of distortion and shrinkage stresses.

After making each run of welding, all slag shall be removed and final run shall be protected by clean boiled linseed oil till approved.

The weld metal, as deposited, shall be free from crack, slag, excessive porosity, cavities and other faults.

The weld metal shall be properly fused with the parent metal without overlapping or serious undercutting at the toes of the weld.

The surfaces of the weld shall have a uniform and consistent contour and regular appearance.

In welds containing crack, porosity or cavities in which the weld metal tends to overlap on the parent metal without proper fusion, the defective portions of the welds shall be out cut and re-welded. Where serious under cutting occurs, additional weld metal shall be deposited to make good reduction. Testing of welded joints shall be done as per relevant IS codes 3600, 3613, 4260, 7205, 7215, 7307, 7310, 7318.

12.10 MODE OF MEASUREMENT:

All structural steel shall be measured on weight basis in metric tonnes or quintals or kgs. as mentioned in the schedule of quantities. The length or areas of various members including gusset plates shall be measured correct to two places of decimals and the net weight worked out from the standard steel tables approved by Indian Standard Institution. No separate measurements shall be taken for welding, riveting, bolting, field connections etc. The rate shall include cost of all labour, materials, scaffolding, and transport and also cost of welding, riveting and bolting, field connections if any all to complete the job as per specifications.

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47. PAINTING:**47.1 SCOPE OF WORK:**

The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here-in-after with the item of schedule of quantities.

47.2 MATERIALS:

Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Ready mixed paints as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-Charge shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnights work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineering-Charge.

The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

47.3 COMMENCING WORK :

Scaffolding: Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No bellies, bamboos or planks shall rest on or touch the surface which is being painted.

Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

For painting of the ceiling, proper stage scaffolding shall be erected. Painting shall not be started until and unless the Engineer-in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

Painting, except the priming coat, shall generally be taken in hand after all other builders work, practically finished.

The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started.

47.4 PREPARATION OF SURFACE:

The surface shall be thoroughly cleaned. All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches if any in plastered/form finished surfaces shall be repaired and finished in line and level in C.M. 1:1 and cracks & crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced.

47.5 APPLICATION:

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.

The external surfaces of the buildings under reference including the R.C.C. Jalli, fins and the panels above and below the window etc. shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Departments approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Departments approval for the same.

The painting shall be laid on evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing & laying off consists of covering the area with paint, brushing the surface hard for the first time and then brushing alternately in opposite directions two or three time and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying will constitute one coat.

Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails.

Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation.

Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly closed.

The final painted surface shall present a uniform appearance and no streaks, blisters, hair marks from the brush or clogging of paint puddles in the corners of panels, angles of mouldings etc. shall be left on the work.

In case of cement based paints/primers, the absorbent surfaces shall be evenly damped so as to give even suction. In any weather, freshly painted surfaces shall be kept damp for at least two days.

In painting doors and windows, the putty around the glass panes must also be painted, but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out while painting. Perspect covers of electrical switch boxes have to be painted from inside by removing them. Care shall be taken while removing them in position after painting with respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

The additional specifications for primer and other coats of paints shall be as in accordance to the detailed specifications under the respective headings. Any damage caused during painting work to the existing works/surfaces shall be made good by the contractor at his own cost.

47.6 BRUSHES AND CONTAINERS:

After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when not in use, shall be closed, kept air tight and shall be kept at a place free from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean & can be used again.

47.7 MEASUREMENT:

- a) Painting, unless otherwise stated shall be measured by area in square metre. Length and breadth shall be measured correct upto two places of decimal of a metre.
- b) No deduction shall be made for opening not exceeding 0.05sqm. and no addition shall be made for painting to the beading, moulding edges, jambs, soffits, sills, architraves etc. of such openings.
- c) In measuring painting, varnishing, oiling etc. of joinery and steel work etc., the co-efficient as in the following table shall be used to obtain the areas payable. The co-efficient shall be applied to the areas measured flat and not girthed in all cases.
- d) In case of painting of door shutter with push plates in plastic laminate, deduction will be made for area of such laminations.

47.7.1 Table of multiplying Co-efficient to be applied over areas of different surfaces to get equivalent plain areas is given in the Appendix-“C-2” of this book.