

10.01 Providing, erecting and fixing in position tubular/ angular steel medium class conforming to IS:806:1968 and IS:1161:1979 for the work of sheds, canopy, space frame etc. including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and welding the members as per detailed drawing and design. The rate shall include for applying two coats of approved make synthetic enamel paint over two coat of zinc chromate yellow oxide , as per instructions. (Only standard measurements will be paid for).

1.0 Materials & Workmanship :

1.1 The relevant specifications of item No. 10.01.b (given below) shall be followed. Prior to fabrication, all rolled sections shall be cold straightened and freed from twists, wraps etc. Hot working shall be done only after prior permission of the Engineer-in-charge. The surface of the members to be welded shall even so that temporary fastening alignment should not allow passage of a 0.2mm. thick filler gauge more than 20mm. deep from the member's edge. All members shall be cut mechanically by saw or shear or by oxyacetylene flame.

1.2 Welding shall generally be done by electric process. Gas welding shall be restored to using oxyacetylene flame with specific approval. Gas welding shall not be permitted for structural steel work.

1.3 The work shall be done as shown in the shop drawings which should clearly indicate various details of the joints to be welded, shop and site welded as well as type of electrodes to be used. Symbol for welding on plans and shop drawing shall be according to I.S. 813-1961. As far as possible every effort shall be made to limit the welding that must be done after improper welding that is likely to be done due to heights and difficult position on scaffolding etc.

The welding work shall conform to I.S. 816-1969.

1.4 Preparation of surface : Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.

1.5 Assembly for welding : Before welding is commenced, the plates shall be first be brought together and firmly clamped or spot welded at specified distance. The temporary connection in form of tack welding, has to be strong enough to hold the plates accurately in place without displacement and shall be done keeping in view the finished dimensions of the structure.

1.6 Precautions : The operations connected with welding and cutting equipment shall conform to safety requirement given in I.S. 818-1968.

The following points shall be borne in mind during the process of welding :

- (a) Welds shall be made in flat position wherever practicable.
- (b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
- (c) The segments of welding shall be such that where possible, the members which offer the greatest resistance to compression are welded first.
- (d) Proper care shall be taken while welding, for shrinkage and distortions, as the drawing dimensions are the finished dimensions of the structure.
- (e) Cutting of the plates shall be by profile cutting only
- (f) All holes shall be cut by static drill or magnetic drill only .no hole shall be

- made by cutting by gas /welding
- (g) welding rod shall be **Ishab India** or equivalent & to be got approved before use
- (h) Approved welder shall be allowed for full /continous welding
- (I) **ALL permanent erection nut bolts shall be ISI make GI coated only.**

- 1.7 The defective welds which shall be considered harmful to the strength shall cut out and rewelded.
- 1.8 Finished welds and adjacent part shall be protected with clean boiled linseed oil and after all stag has been removed welds and adjacent parts shall be painted after the same are approved.
- 1.9 All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming two coat of zinc chromate yellow oxide paint before fixing them in position. All fabricated members shall be suitably packed to be protected from any damage while transportation, if any.
- 1.10 Grinding to the finished level is to be done, if directed by the Engineer in charge. All exposed weld shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed of with water before painting unless alkali resistant paint is used.
- 1.11 Erection in general, of the entire/part structure shall be carried out as per the requirement and approval of the Engineer-in-charge. Positioning and levelling of the structure, alignment and plumbing and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of the Engineer-in-charge. The following checking and inspection shall be carried out before, during and after erection :
- Damages during transportation
 - Accuracy of alignment of structures
 - Erection according to drawings and relevant specifications.

2.0 Mode of measurement & payment :

- 2.1 The relevant specifications of item No. 10.01 shall be followed.
- 2.2 The rate shall be for unit of one kg.
- 2.3 Only standard sectional weight will be considered & welding will not be considered in weight.

E02 Supplying, fabricating and erecting in position Structural Steel works (In R.S. joists / plates / channels / flats / angles / tees / Hollow sections / Pipes and other structural sections, etc.) in Welded or bolted, in built-up sections, trusses, murals and other framed works for main gate & other sections including cutting, hoisting, fixing in position, applying a priming coat of Yellow zinc chromate primer and painting with two coats of synthetic enamel paint of approved colour & shade, etc. complete all as per specifications for all heights / all floors / all levels . The material shall be conforming to relevant IS Statndards and Fabriction shall be according to to IS. Welding shall be carried out by qualified welders. Electrodes for welding, the procedure, selection, test and inspection shall conform to provisions in IS 816, IS 818, IS 822, and IS 833. Erection/ hoisting shall commence only after passing of fabricated parts by the Engineer -in- charge..

1.0 Material & workmanship;

The relevant specifications of item No. 10.01 shall be followed except that that the work shall be carried out with steel sections as specified in the item.

3.0 Mode of measurement & payment ;

- 3.1 The relevant specifications of item No. 10.01 shall be followed.
- 3.2 The rate shall be for unit of one MT.
- 3.3 Only standard sectional weight will be considered & welding will not be considered in weight

10.01.b Providing, erecting and fixing in position tubular steel sections having nominal bore 32mm, 50 mm, 80mm, 100 mm medium class confirming to IS:808, IS:1161 & relevant latest IS standards for the work of for sheds, canopy, space frame etc. including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and riveting the members as per detailed drawing and design. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).

1.0 Materials & Workmanship :

- 1.1 The relevant specifications of item No. 10.01.a shall be followed and in addition, the following clauses shall be followed.

- 1.2 For assembling the Web plates for girders, which have no cover plates, shall have their end flush with the top od angles unless otherwise required. The web plates when spliced shall have a clearance of not more than 5mm. The erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 1.5mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm. at each end but where for practical purposes, greater clearance is necessary, suitable designed seating shall be provided.

Column splices and butt joints of struts and compression members shall be accurately machined and close-buttred over the whole section. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc. shall be accurately assembled so that the parts abutting against each other over the entire surface of contact.

- 1.3 Erection : Steel work shall be hoisted and erected in position carefully, without any damage to itself. The method of erection proposed by the Contractor shall be got approved from the Engineer-in-charge. The contractor shall be responsible for safe and proper erection without unduly stressing the various members. Proper equipment such as derricks, lifting tackles, winches, ropes etc. shall be used.

The work may be erected in suitable parts as may be directed by the Engineer-in-charge. Fabricated members shall be lifted at such points so as to avoid the deformation or excessive stress in members. The structure or the part placed in position shall be secured against overturning or collapse by suitable means. The steel work shall be placed in proper position as per the approved drawings. Final riveting or permanent bolting shall be done only after proper alignment has been achieved.

Trusses shall be lifted only at the nodes. The trusses above 10m in span shall not be slinged at the apex, as it shall develop compression stresses in the bottom member. They shall be lifted by slinging at the two midpoints of the rafters, which shall be temporarily braced by wooden

member of suitable section. After the trusses are placed in position, purlins and wind bracing shall be fixed as soon as possible.

The end of the truss which faces the prevailing winds shall be fixed with holding down bolts and the other end shall be kept free to move. For spans upto 10m, the free end of the truss shall be laid on lead sheet or steel plate as per design and the holes for holding down bolts shall be made in the form of oblong slots so as to permit the free movement. For larger spans, the bearing shall be as per design.

Columns and stanchions shall be erected truly vertical with the necessary cross bracing etc. as per drawing. The base shall be properly fixed with the foundation concrete by means of anchor bolts etc. as per design. Anchor bolts shall be placed in concrete foundation. They shall be held in position with a wooden template. The anchor bolts shall be provided with suitable timber mould or pipe sleeve to allow adjustment, which shall be removed after the initial set of concrete. The spaces left around the anchor bolts shall have a slopping channel leading to the side of the pedestal and on the underside of the base plate to allow spaces being grouted up after the base plate is fixed in position. Grouting shall be in CM 1:3 or as specified.

Bedding of column, stanchions etc. shall not be carried out till the steel work has been finally levelled, plumbed and connected together. The stanchion shall be supported on steel wedges and adjusted to make the column plumb. For multi-storied buildings, the bedding shall not be done till sufficient numbers of bottom lengths of stanchions have been properly lined, levelled and plumbed and sufficient floor beams are fixed in position. The base plates shall be wedged clear of the base by MS wedges and adjusted where necessary to plumb the columns. The gaps under the base plates upto 25 mm shall then be pressure grouted with cement grouts.

Painting : Relevant specification of item no.6.01.a shall be followed.

2.0 Mode of measurement & payment :

2.1 The relevant specifications of item No. 10.01.a shall be followed.

2.2 The rate shall be for unit of one kg.

2.3 Only standard sectional weight will be considered.

10.02 Fabricating, Providing and fixing skylight of approved make and design and as per Engineer-in-charge's instruction on skylight only clear dimension should be paid for.

The relevant specification of item no. 10.01 shall be followed same except that the work of fabricating and providing Skylight shall be carried out with rolled steel sections as specified in the item.

The rate includes cost of materials labour, required for complete of the item including hoisting, carriage, temporary erection like scaffolding, etc.

10.03 Providing, erecting and fixing in position inser plates ,railings,chain link or barbed wire MS frame work,monkey ladder spiral staircase made from equal and unequal angles, flats, channels, square, rectangular or round hollow tubes, plates and perforated sheet of different sizes as per detailed drawing and design including grinding the welded spots & paint. The rate shall include for applying two coats of approved make synthetic enamel paint over two coats of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with steel sections as specified in the item.

- 10.04** **Fabricating, supplying and fixing in position cattle trap, railings, gate etc. made from rolled steel sections (equal and unequal angles, flats, channels, square tubes and plates of different sizes) as per detailed drawing and design including filling the welded spots with paint. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).**

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with rolled steel sections as specified in the item.

- 10.05** **Providing, erecting and fixing in position tubular steel sections of various sizes of medium class confirming to IS:806:1968 and IS:1161:1979 for the work of skylight, including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and welding the members as per detailed drawing and design. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).**

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with tubular steel sections as specified in the item.

- 10.06** **Providing, erecting and fixing in position tubular steel sections of various sizes of medium class confirming to IS:806:1968 and IS:1161:1979 for the work of monkey ladder, spiral staircase including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and welding the members as per detailed drawing and design. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).**

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with tubular steel sections as specified in the item.

- 10.07** **Providing, erecting and fixing in position tubular steel sections of various sizes of medium class confirming to IS:806:1968 and IS:1161:1979 for the work of cattle trap, railings, gate etc. including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and welding the members as per detailed drawing and design. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).**

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with tubular steel sections as specified in the item.

- 10.08** **Providing and fixing weld mesh jali**

1.0 **Materials :** Weld mesh jali shall conform to M-34

2.0 **Workmanship :** The relevant specification of item 10.01 shall be followed except that the

work of weld mesh jali shall be carried out as per detail drawings and instructions of Engineer-in-Charge. The MS Angles, MS Flats etc. shall be used as described in items. The rate also includes providing one coat of zinc chromate yellow oxide and two coats of enamel paint.

3.0 Mode of measurement & payment: The rate shall be for unit of One sq.mt. Clear visible area of the shutter shall be measured.

10.09.a Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover(16 gauge), spring, axles, guide rails (10gauge), tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 2 coat of zinc chromate primer and 2 coats of synthetic enamel paint of approved make & shade etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.) rates shall be inclusive of fixing two no of 35x35x6 mm angles one leg to guide by welding & other leg to wall by anchor fastener of Hilti/Fischer a) with push and pull arrangement.

1.0 Materials : Rolling shutter shall conform to M-32, Enamel paint shall conform to M-44.

2.0 Workmanship : The top cover, spring, axles, tees, iron pulleys etc. shall be supported on strong MS / CI brackets which shall be fixed into the CC 1:2:4 of the lintel/beam as specified with anchor fastener, screws, bolts etc. The guide rails shall be fixed on to the sides of the opening as per the manufacturer's instructions. The lathe curtain (shutters) shall be laid on ground and the side-guide rails shall be bound with it with ropes etc. The shutter shall then be placed in position and top fixed with suspension shaft with bolts and nuts. The side-guide channels and the cover frame shall then be fixed to the walls through the plate welded to the guides. These plates and brackets shall be fixed by means of steel screw bolts and rawl plugs drilled in the wall. The plates and screw bolts shall be concealed in plaster to make their location invisible.

Fixing shall be done accurately so as to ensure easy and smooth operation of the shutter.

3.0 Mode of measurement and payment :

3.1 Measurement considered for payment shall be clear size of opening, between the jambs plus guide channels on both the sides for width and 450mm on top for drum height shall be added to the height of the opening, the clear distance between the sill and the soffit of the opening.

3.2 The rate shall include for all materials, its transportation at site, labour etc. involved in the operation described as above. It shall include for a primer coat and 2 coats of enamel paint.

3.3 The rate shall be for a unit of one sq. m.

10.09.b Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover, spring, axles, guide rails, tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 1 coat of zinc chromate yellow oxide primer and 2 coats of synthetic enamel paint of approved make etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.) b) with mechanical device with a pair of handles.

The relevant specifications of item no. 10.09.a shall be followed except that the shutter shall be operated with a mechanical device with a pair of handles.

- 10.09.c** Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover, spring, axles, guide rails, tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 1 coat of zinc chromate primer and 2 coats of synthetic enamel paint of approved make etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.)
c) shutter shall be partly grilled and partly panelled and pull and push type.

The relevant specifications of item no. 10.09.a shall be followed except that the shutter shall be partly grilled and partly panelled, operated with pull and push type arrangement.

- 10.09.d** Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover(16 gauge), spring, axles, guide rails (10gauge), tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 2 coat of zinc chromate primer and 2 coats of synthetic enamel paint of approved make & shade etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.) rates shall be inclusive of fixing two no of 35x35x6 mm angles one leg to guide by welding & other leg to wall by anchor fastener of Hilti/Fischer
d) shutter shall be partly grilled and partly panelled, mechanically operated with a pair of handles.

The relevant specifications of item no. 10.09.a shall be followed except that the shutter shall be partly grilled and partly panelled, operated with a mechanical device with a pair of handles.

- 10.09.e** Providing and fixing in position, interlocking rolling shutter of approved make, of 18 gauge, 75mm wide cold rolled MS lath interlocked, including top cover(16 gauge), spring, axles, guide rails (10gauge), tees, iron pulleys, bearings, handles, holding down bolts embedded in CC 1:2:4 including 2 coat of zinc chromate primer and 2 coats of synthetic enamel paint of approved make & shade etc. as directed. (Measurements considered for payments shall be clear size of opening plus guide channels on both the sides for width and 450mm on top for drum height.) rates shall be inclusive of fixing two no of 35x35x6 mm angles one leg to guide by welding & other leg to wall by anchor fastener of Hilti/Fischer.
e) shutter shall be partly grilled and partly panelled, electrically operated with wiring & panel & mechanically operated with a pair of handles etc complete with minimum one year guarentee of electrical items.

The relevant specifications of item no. 10.09.a shall be followed except that the shutter shall be partly grilled and partly panelled, electrically operated with wiring & panel & mechanically operated with a pair of handles etc complete with one year guarantee of electrical items.

- 10.10.a** Providing and fixing 1M. high, 32mm dia. G.I 'A' class pipe railing with verticals of 32mm dia. pipe with MS hold fast 25mm x 6mm x 10cm long, grouted in floor with CC 1:2:4 blocks fo size 15 x 15 x 23 cm., at 1M c/c or with anchor fastener with intermediate 32mm dia. GI pipe welded at all junctions, grinding smooth the welded joints and ends, including 2 coat of zinc chromate yellow oxide primer and 2 coats of synthetic enamel

paint of approved make etc. as directed.

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with 32mm GI 'A' class pipes as specified in the item.

The rate includes cost of materials, labour, required for completion of the item.

The relevant specifications of item no. 13.02 shall be followed for fixing the railing in CC 1:2:4 blocks of 15 x 15 x 23cm. size. The items of excavation and 1:2:4 C.C shall be measured according to relevant items and the detailed specifications for the same.

The rate shall be for a unit of one running metre. Excavation and C.C 1:5:10 shall be paid extra under the head of the relevant items and as per respective unit.

10.10.b - Do - as above but for 300mm high guard rail, without intermediate members.

The relevant specifications of item no. 10.10.a shall be followed except that the railing shall be 300mm high with no intermediate rails.

10.11 Providing, fabricating, erecting and placing in position MS structural steel work in roof trusses, columns, beams, bracing, platforms, stairs, brackets from Rolled sections ,plates ,angles channels & I beams etc., including cutting, wastage, welding (shop and site), bolting wherever necessary, including 2 coat of zinc chromate yellow oxide primer and 2 coats of enamel paint in approved shade etc. complete as directed.

The relevant specification of item no. 10.01 shall be followed same except that the work shall be carried out with structural steel sections as specified in the item.

10.12 Providing, fabricating and fixing MS Grills of required Pattern as per approved drawing, design and direction to window frames with MS flats/square/round bars at required spacing and frame all around fixed with Screws to window frame including two coats of painting with two coats of zinc chromate yellow oxide etc. complete.

1.0 Materials : The structural steel shall conform to M-22.

2.0 Workmanship :

2.1 The MS Grill shall be prepared as per the drawings or as directed for fixing to wooden frames of windows etc.

2.2 The grill shall be fabricated to the designs and patterns shown in the drawings and the weight shall be as directed, and the joints shall be riveted or welded as shown in the plan or as directed. The grill so framed shall be fixed in to the frames of the windows etc. before they are erected in position. The outside strip frame of the grill shall be housed to its full thickness into the recess cut into the frame of the windows etc. The grill shall be fixed to the frame with number of bolts and nuts of screws viz. bolt nut/screw per 30 cm. of the length of outer strip subject to a minimum of 2 Nos. on each side of the frame or as indicated in the drawings or as directed.

2.3 The bolts and nuts or screws shall be counter sunk and shall be fixed with the top of their heads flush with the face of frame strips.

3.0 Mode of measurement & payment :

- 3.1 No payment shall be made for weight of screws, bolts, nuts etc. Only weight of grill shall be paid.
- 3.2 The rate shall be for unit of one Kg.
- 6.01.a Steel work, riveted, in built-up sections, framed work, including cutting, hoisting fixing in position and applying a 2 coat of zinc chromate yellow oxide/red oxide primer and 2 coats of synthetic enamel paint, in Door/Window/Ventilator steel frames, shutters and the like.**
- 1.0 Materials :** The structural steel work shall conform to M-22. Zinc cromate yellow oxide/red oxide primer to IS:102-1962. Enamel paint to M-44.
- 2.0 Workmanship :**
- 2.1** The steel sections, as specified or required, shall be straightened and cut square, to the correct lengths, as per drawings and design, measured with a steel tape. The sections shall be cold straightened and the finished goods shall be free from bending, twisting and other such defects. The cut ends, exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed, to make up the required length or member, except as indicated in the drawing or as directed. All straightening and shaping, to form the specified shape and size shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner, as not to impair the strength of the metal. All operations shall be done in cold state, unless otherwise directed/permitted.
- 2.2 Steel riveted or bolted, in built-up sections, frame work :**
- 2.2.1** The steel structure as shown in the drawings or as per direction of the Engineer-in-charge, shall be laid out on a level platform to full scale or in parts. A steel tape shall be used for measurements to ensure maximum accuracy.
- 2.2.2** The rate shall include all means of hoisting to places with scaffolding and equipments, etc., cutting chases, etc. in walls and floors of R.C.C., neat finishing, concreting, etc.
- 2.2.3** Wooden templates 12 mm. to 19 mm. thick, or metal sheet template shall be made to correspond to each connecting gusset plate/member and rivet holes shall be accurately marked on them and drilled. The templates shall be laid on the steel members, and holes of the steel members shall also be marked for drilling. The base of steel columns and the position of the anchor bolts shall be carefully set out.
- 2.2.4** All stiffeners shall be formed by pressure and where practicable, the metal shall not be cut and welded in making these. In major works or where so specified, shop drawings giving complete details and information for the fabrication of the component parts of the structure, including location, type, size, length and details of rivets, bolts, or weld shall be prepared in advance of the actual fabrication. The drawings shall indicate the shop and field rivets and bolts. The steel members shall be distinctly marked or stenciled with paint with the identification mark, as given in the shop drawings.
- 2.2.5** Great accuracy shall be observed in fabrication of various members, so that these can be assembled without being unduly packed, strained or forced into position and when built-up, shall be true and free from twists, links, buckles or open joints. Before making holes in individual members for fabrication, the steel work intended to be riveted or bolted together, shall be assembled or clamped properly and tightly, so as to ensure close abutting or lapping of surfaces of the different members, with proper jigs and fixtures. All contact surfaces shall be cleaned and

given a coat of primer. All stiffeners shall bear tightly, both at top and bottom, without being drawn or caulked. The abutting joints shall be cut or dressed true and straight, in the required manner, as per the details and fitted close together, properly and tightly.

- 2.2.6 Web splice plates and fillers under stiffeners, shall be cut within 3 mm. to fit properly, or flange angles, web plates of girders shall have their ends flush with the top of angles forming the flanges, unless otherwise required. The web plates when spliced shall have clearance of, not more than 6 mm.
- 2.2.7 The erection clearance for cleared ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm. at each end but where for a practical reason greater clearance is necessary, suitably designed seating shall be provided.
- 2.2.8 Pins and rollers shall be accurately turned to gauge. These shall be straight and smooth and free from flaws. The roller bearing shall be provided with adequate arrangement for holding the girders or trusses resting on it. In columns caps and bases, the ends of shafts together with the attached gusset angles, channels etc., after riveting together shall accurately be mechanised so that the parts butt connected against each other over the entire surface of contact, connecting angles or channels shall be fabricated and placed in position with greater accuracy so that they are not unduly reduced in thickness by machining.
- 2.2.9 The ends of bearing stiffeners shall be mechanised or ground to fit tightly, both at the top and bottom. All holes shall generally be drilled to the required size and at required position. Sub punching shall be permitted, provided it is done 3 mm. or less in diameter and reamed thereafter to the required size. The holes for rivets and bolts shall be larger than the nominal diameter of rivets or black bolts, as allowable by IS : 800.
- 2.2.10 Holes shall have their axis perpendicular to the surface bored through. The drilling or reaming shall be free from burrs and the holes shall be clean and accurate, to the diameter specified in the drawings. No enlargement of the holes by filling, man drilling or oxyacetylene flame shall be allowed. Maximum deviation for spacing of two holes shall be ± 1 mm. Holes for counter sunk bolts shall be made in such a manner, that their heads fit flush with the surface after fixing. Hole reaming shall be allowed only if the number of faulty holes do not exceed 15% of the total number of holes for one joint.
- 2.2.11 The fabrication work shall be completed in workshop as far it is practicable to do so. Site joints shall be done with rivets and fitted bolts or black bolts, as shown in the drawings or as directed. Generally the following principles shall govern the use of rivets, turned and fitted bolts, and black bolts.
- (i) Rivets and turned and fitted bolts shall be used where the connection required is of such a nature, that slip under load has to be avoided.
 - (ii) Black bolts may be used very sparingly where a force is carried through a connection without impact, vibration or reversal of stresses.
- 2.2.12 **Assembly :** The parts assembled for riveting shall be in close contact with each other and the bearing stiffeners shall bear tightly, both at top and bottom, without being drawn or caulked. The abutting joints shall be cut or dressed true and straight and fitted close together. Members to be riveted shall be properly pinned or bolted and rigidly held together while riveting. Hole for rivets and black bolts shall be of nominal diameter plus 1.5 mm., for rivets of nominal diameter less than 25 mm. and 2.0 mm., for rivets of nominal diameter exceeding 25 mm., unless specified otherwise. Drifting of holes shall not be permitted except to draw the parts together and the

drifting tools so used shall have maximum diameter not exceeding the nominal diameter of rivets or bolts. Drifting done during assembling shall not distort the metal or enlarge the holes.

2.2.13 **Riveting :**

- 2.2.13.1 Rivets shall be used where the connection is such that slip under load has to be avoided.
- 2.2.13.2 Members to be riveted shall have all their parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.
- 2.2.13.3 The shanks of rivets shall project beyond the plate surface sufficiently so as to fill the hole thoroughly and form the required head after riveting.
- 2.2.13.4 The riveting shall be done by hydraulic or pneumatic process. However, where such facilities are not available, hand riveting may be done, if permitted by Engineer-in-charge. The rivet shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than 10 mm. may be fitted cold. Rivets shall be heat finish with heads full and of equal size. All loose, burnt or badly formed rivets with concentric or different heads shall be cut out and replaced. The heads of rivets shall be central to shanks and shall grip the assembled members firmly. In cutting out rivets, care shall be taken so as not to injure the rivets and the assembled members. Caulking or reoccupying shall not be permitted.
- 2.2.13.5 For testing rivets, hammer weighing approximately 0.25 Kg. shall be used. Both heads of the rivets shall be tapped, slack rivets will give a hollow sound and a jar.
- 2.2.13.6 All rivet heads shall be painted with red lead paint, within a week of their fixing.
- 2.2.14 While bolting, all bolt heads and nuts shall be hexagonal and of equal size, unless specified otherwise. The screwed threads shall conform to IS : 1363-1960 and the threaded surface shall not be tapered.
- 2.2.15 The nominal length of the bolt shall be the distance from the underside of the head to the farthest end of the shank. The nominal diameter shall be the diameter at the shank above the screwed threads. Bolts, nuts, washers shall be thoroughly cleaned and dipped in double boiled linseed oil, before use. The bolts shall be of such length so as to project atleast 2 clear threads beyond the nuts when fixed in positions and these shall fit in the holes without any shakes. The nut shall be fit in the threaded ends of bolts properly, i.e by tightening them so as to transfer the required tension. Where turned and fitted bolts are required to be used in place of rivets, they shall be provided with washers not less than 6 mm. thick so that the nut when tightened shall not bear on the unthreaded body of the bolt. Tapered washers shall be provided for all heads and nuts bearing on levelled surfaces. The threaded portion of the bolts shall not be within the thickness of the parts bolted together, it shall project through the nut atleast by 2 thread. The faces of the bolt heads and nuts abutting against steel members shall be machine finished. Where there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of lock nuts and spring washers of cross-cutting, as directed.
- 2.2.16 Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming coat of red lead oxide and 3 coats of synthetic enamel paint as per relevant specifications of painting item no. 11.08a and 11.09. However, the application shall be such that the first coat of paint shall be much lighter than the final coat, the second coat shall be slightly lighter than the final coat and the final coat shall be exactly of the shade specified. This differentiation is done to demarcate the no. of

application of painting coats.

3.0 Mode of Measurements and Payment :

- 3.1 (a) All work shall be measured on the basis of finished dimensions, as fixed on site and measured net unless specified otherwise.
 (b) The weight of steel sections, steel strips in finished works shall be calculated from standard weight on the same basis on which steel is supplied to the Contractor by the Institute or those given in relevant IS Codes, if steel is arranged by the contractor.
 (c) The weight of steel plates and strips shall be taken from relevant IS Codes, based on 7.85 kg/m² for every mm. sheet thickness, if steel is supplied by the Contractor, otherwise, the weight shall be calculated on the basis on which steel is supplied to the Contractor by the Institute.
 (d) Unless otherwise specified weight of cleats, brackets, packing pieces, bolts, nuts, washers, distance pieces, separators, diaphragm gusset (taking over all square dimension) fish plates etc. shall be added to the weight of respective items.
 (e) In riveted work, allowance shall be made for weight of rivet heads. No deductions shall be made for rivet or bolt holes excluding holes for anchor or holding down bolts.
 (f) For forged steel and steel castings, weight shall be calculated on the basis of 7850 kg/m³.
 (g) Unless otherwise specified an addition of 2.5% of the weight of structure shall be made for shop and site rivet heads in riveted steel structure.
 (h) Dimensions other than cross sections and thickness of plates shall be measured to nearest 0.001 m.
 (i) Mill tolerance shall be ignored when weight is determined by calculation.

- 3.2 The rate includes cost of all material, labour, erection, hoisting, scaffolding, safety measures and sundry required for proper completion of the item of work, at all heights. This shall also include conveyance and delivery, handling, loading, unloading and storing etc. required for completion the item described above including necessary wastage involved.

- 3.3 The rate shall be for an unit of one kg.

6.01.b Steel work, welded, in built-up sections, framed work, including cutting, hoisting fixing in position and applying a priming coat of zinc chromate yellow oxide paint and 2 coats of synthetic enamel paint, in Door/Window/Ventilator steel frames, shutters and the like.

- 1.0 **Materials :** Structural steel shall conform to M-22. Zinc chromate yellow oxide primer to IS : 102-1962. Enamel paint to M-44.

2.0 Workmanship :

- 2.1 The relevant specifications of item No. 6.01 shall be followed except that the steel work shall be done by welding. Straightening, shaping to form, cutting and assembling shall be as per item no. 6.01.a as far as applicable except that the words 'riveted or bolted' shall be read as 'welded' and holes shall be made for the bolts used for temporary fastening as shown in drawings. The definition of various terminology in welding process shall be as follows :

- 2.1.1 **Run :** The metal deposited during one passage of the electrode or blow pipe, in making of a joint.

- 2.1.2 **Bead :** A single run of weld metal deposited on a surface.

- 2.1.3 **Weld :** An union between two pieces of metal at faces rendered plastic or liquid by heat or by

pressure or both. Filler metal may be used to effect the union.

2.1.4 **Weld metal** : All metal melted and/or made plastic in making a weld.

2.1.5 **Butt weld** : A weld in which the weld metal lies substantially within the extension of the planes of the surfaces of the parts joined or within the extension of the planes of the smaller of the 2 parts, of different size. The edges of the metal pieces shall be bevelled or chiselled to the required shape at the throat, for which no extra payment shall be made.

2.1.6 **Crater** : A depression left in the weld metal where the arc was broken or the flame was removed.

2.1.7 **End crater** : A crater at the end of a weld or at the end of a joint.

2.1.8 **Fillet weld** : A weld of approximately triangular cross-section joining two surfaces, approximately at right angles to each other in a lap joint, tee joint or corner joint. It shall be of two types 1) Continuous 2) Intermittent.

2.1.9 **Fusion welding** : Any welding process in which the weld is made between metals in a state of fusion without hammering or pressure.

2.1.10 **Fusion Penetration** :

2.1.10.1 **In fusion welding**, the depth to which the parent metal has been fused.

2.1.10.2 **In spot, seam or projecting welding**, the distance from the interface to the edge of the weld nugget, measured in each case on a cross-section through the center of the weld and normal to the surface.

2.1.11 **Non-fusion welding** : A term applied to the deposition by Oxy-Acetylene process, of filler metal on parent metal, without fusion of the latter.

2.1.12 **Oxy-Acetylene pressure welding** : Pressure welding in which an Oxy-Acetylene flame is used to make plastic the surface, to be united. No filler metal is used.

2.1.13 **Throat** : In a resistance welding machine, the distance from the center line of the electrodes or platens to the nearest point of interference for flat work or sheets. In case of seam-welding machine with an universal head, the throat depth is measured with the machine arranged for transverse welding.

2.1.14 **Throat thickness** : The minimum thickness of weld metal in a fusion weld measured as under :
a) For a fillet weld or A, V, U, J or a bevel butt weld : Along a line passing through the roof.
b) For a close square-butt-weld : In the plane of the abutting faces.
c) For an open square-butt-weld : At the center of the original gap in a plane parallel to the fusion faces.

2.2 Welding shall generally be done by electric process. The electric arc welding is usually adopted and is economical. In absence of electricity, generators shall be used. Gas welding shall be restored to using oxyacetylene flame with specific prior approval. Gas welding shall not be permitted for structural steel work as it requires heating of the members along with the welding rod and temperature stresses are likely to be developed in the welded members. Precautions shall be taken to avoid distortion of the members due to temperature stresses.

2.3 The work shall be done as shown in the shop drawings which should clearly indicate various

details of the joints to be welded, shop and site welded as well as type of electrodes to be used. Symbol for welding on plans and shop drawing shall be according to IS : 813-1961. As far as possible, every effort shall be made to limit the welding that must be done after erection so that, improper welding that is likely to be done due to heights and difficult position on scaffolding etc., after erection, is avoided. The maximum diameters of electrodes for welding any work shall be as under, unless otherwise specified.

Average thickness of plate or section.	Maximum dia. of electrode to be used.
Less than 5 mm.	3 mm.
5 mm. upto but not including 8 mm.	4 mm.
8 mm. upto but not including 10 mm.	5 mm.
10 mm. upto but not including 16 mm.	6 mm.
16 mm. upto but not including 25 mm.	9 mm.
25 mm. and over	9 mm.

The welding work shall conform to IS : 816-1969.

- 2.4 **Preparation of surface :** Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.
- 2.5 **Assembly for welding :** Before welding is commenced, the plates shall be first brought together and firmly clamped or spot welded, at specified distance. The temporary connection has to be strong enough to hold the plates accurately in place without displacement.
- 2.6 **Precautions :** The operations connected with welding and cutting equipment shall conform to safety requirement given in IS : 818-1968.
- 2.7 **Welding process :** The following points shall be borne in mind during the process of welding :
 (a) Welds shall be made in flat position wherever practicable.
 (b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
 (c) The sequence of welding shall be such that where possible, the members which offer the greatest resistance to compression are welded first.
 (d) Freedom of movement of one member of the joint shall be allowed wherever possible. Wherever joints shall be welded allowance shall be made for the movement of one component to the order of 1.5 mm.
 (e) The electrode manipulation during welding shall be such as to ensure that (1) The base metal is in fused stage when the filler metal makes contact with it. (2) The filler metal does not overflow upon any unfused base metal. (3) The base metal is not under-cut along the weld edges. (4) and that the metal floats, the slag, the oxides and the gas that bubbles to the surface behind the advancing pool.
- 2.8 Each time the arc is started, the electrode shall be moved in such a way that the fusion of the base metal at the starting point is assured. At the completion of a run the movement of electrode shall be adjusted or the electrode size changed.

- 2.9 After every interruption of the arc except at the completion of a run, the arc shall be restarted ahead of previous deposit and then moved back to fill the crater or such alternative technique shall be used as will ensure complete filling of the crater or complete fusion between the new and old deposits and the base metal at the point of junction and result in continuous weld. Before the welding operation is completed, all traces of slag shall be removed from the deposit, by chipping if necessary and the deposit and the adjoining base metal shall be wire brushed and cleaned at all points. The requirements shall apply not to successive layers, but also to successive beads and to the overlapping area wherever a junction is made on starting a new electrode.
- 2.10 The weld shall be free from cracks, discontinuity and other defects like under size, over size, under-cutting etc. All the defective welds which shall be considered harmful to the strength shall cut out and re-welded.
- 2.11 Finished welds and adjacent part shall be protected with clean boiled linseed oil and after all slag has been removed from the welds and adjacent parts, painting shall be done after the same is approved.
- 2.12 All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming coat of red lead paint before fixing them in position.
- 2.13 Grinding to the finished level is to be done, if directed by the Engineer-in-charge. All expose weld shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed off with water before painting unless alkali resistant paint is used.
- 2.14 For erection the relevant specifications of item no. 6.01.a shall be adopted except that while erecting a welding structure, adequate means shall be employed for temporary fastening the members together and bracing the framework until the joints are welded. Such means shall consist of bolts, tack welding or other positive devices imparting sufficient strength and stiffness to resist all temporary loads and lateral forces including wind.

3.0 Mode of Measurements and Payment :

- 3.1 The relevant specifications of item No. 6.01.a shall be followed. The weight of welding material shall not be added in the weight of members for payment and nothing extra shall be paid for making and filling the temporary fastening of members during erection before welding.
- 3.2 The rate shall be for an unit of one kg.
- 3.3 Only standard sectional weight will be considered and welding will not be considered in weight.

E03 Supplying and tying G.I. Barbed wire consisting of 2 ply line wire having nominal diameter of 2.5mm (Tolerance + OR - 0.8mm), point wire (Barbs_ of nominal diameter 2mm (Tolerance + OR - 0.8mm) with the barbs having four points, including tying in between fencing posts, stretching wires and providing diagonals, including tying to posts with G.I. wire of dia 1.6mm (16g) and fixing the wires to nib in the posts, etc complete all as per drawing and specifications.

Note: 1. The G.I. barbed wire shall weigh minimum 10.8kg / 100mtr and maximum 12.5 kg / 100mtr with barbs placed at 75mm c/c (Tolerance + OR - 12mm) and the barbed wire shall conform to IS 278 - 1978. 2. The length of each row and each diagonal row of barbed wire will be measured in running metre for payment. G.I. binding wire will not be

measured for payment. Note : The quoted rate should inclusive of cost for binding wire also).

Material & workmanship ;

1.1 posts The relevant specification of item 10.01a shall be followed for fabrication & erection of MS

1.1 The post shall be fabricated & erected in line level & plumb very precisely.

1.0 Mode of measurement;

1.1 The length of each row and each diagonal row of barbed wire will be measured in running metre for payment the wire shall be measured in rmt .

1.2 MS post as per drawing shall be fabricated & erected as per specifications of item no 10.01a & shall be measured and paid under same item separately in kg.

13.02 Providing and fixing 1.20 m. high fencing with 2 m. long M.S. angle posts, 40 mm. x 40 mm. x 6 mm. size and oil painting in 3 coats, fixed at 2.5 m. C/C., with five horizontal lines and two diagonals of galvanised steel barbed wire, weighing 9.38 Kg. per 100 m. (Min.), strained and fixed to posts with G.I. staples, including fixing the post in ground with 0.5 x 0.5 x 0.5 m. block of C.C. 1:5:10 (1 cement : 5 sand : 10 graded brick aggregate, 40 mm. nominal size) etc., complete.

1.0 Material : 1.1 Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Bricks bats aggregate shall conform to M-14. Oil paint shall conform to M-44. Barbed wire shall conform to M-65. Structural steel shall conform to M-22.

2.0 Workmanship :

2.1 The pits of the size 0.5 m. x 0.5 m. x 0.5 m. shall first be excavated, true to line and level, to receive the post at 2.5 m. C/C. The relevant specifications of item 1.01 shall be followed for excavation work.

2.2 The pits shall be filled with a layer of 0.15 m. thick lean concrete 1:5:10 (1 cement : 5 Sand : 10 graded brick bat aggregates, 40 mm. nominal size). The M.S. angle, 40 mm. x 40 mm. x 6 mm. shall be then placed over the concrete in true line and plumb. The remaining portion of block shall be filled in with lean concrete 1: 5:10 and rammed properly so as to form total 0.5 m. x 0.5 m. x 0.5 m. concrete block. The concrete shall be cured for 7 days to allow it to set. For lean concrete 1:5:10, relevant specifications from section 2.00 shall be followed.

2.3 The barbed wire shall be stretched and fixed in 5 horizontal rows and two diagonals. The bottom row shall be 140 mm. above ground and the rest, at 125 mm. center to center. The diagonal shall be stretched between adjacent posts from top wire of one post to the bottom wire of the next post. The wires shall be fixed to the posts by means of staples.

2.4 The M.S. angle posts shall be painted with 3 coats of oil paint of approved tint and shade. The relevant specifications of section 11.00 shall be followed.

3.0 Mode of Measurements and Payment :

- 3.1 The work shall be measured for the finished work from center to center of the posts. The items of excavation and 1:5:10 C.C shall be measured according to relevant items and the detailed specifications for the same.
- 3.2 The rate shall include the cost of all labour and materials (its taxes, levies, transportation etc.) involved in the operations described above.
- 3.3 The rate shall be for an unit of one rmt. Excavation and C.C 1:5:10 shall be paid extra under the head of the relevant items and as per respective unit. The rate includes the cost of painting.

L12 Supplying and fixing chain link fencing using G.I chain link fencing tied to the post , etc; all as directed by the Engineer-in-charge.

**Using G.I CHAIN LINK FENCING of size 50 x 50 x 10g x 10g.
Material**

G.I. Chain link fabric fencing of required width in mesh size 50 x 50 or 25 x 25 mm or specified otherwise of approved brand and made of specified dia GI wire PVC coated of specified thickness / or not as specified in item of required colour or shade to be used.

2.0
mm

Fixing : GI chain link shall be stretched and fixed in specified width, strengthening with 2

dia wire or nuts bolts & washers as required to be done complete as per the direction of Engineer-in-Charge.

3.0
be

Measurements : The length and width shall be measured correct to a cm. The area shall

calculated in square metre, correct to two places of decimal.

The rate shall include the cost of material and labour involved in all the operations described as above.