

BOKARO POWER SUPPLY CO.(P) LTD

**TECHNICAL SPECIFICATION
FOR FABRICATION, ERECTION PAINTING AND CLADDING
OF STEEL STRUCTURES
FOR ELECTRICAL REPAIR SHOP**



MECON LIMITED, RANCHI –834 002.

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AMENDMENT SHEET

Sl No.	Amendment No / Sheet No	Letter Reference with Date

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SECTION 01 – SCOPE AND GENERAL DESCRIPTION OF WORK

01.01 GENERAL

This specification shall apply to fabrication and erection of steel structures and cladding of structural buildings in general.

01.02 UNITS

Structural steelwork under the scope of this specification shall consist of the units broadly described under the clause no. 01.04

01.03 LIST OF STEEL STRUCTURES

The steel structures consist of the following but not limited to these.

- Columns, column bracings, Shear Lugs.
- Crane Girders, surge girder, auxiliary girder.
- Crane walkway, crane rail and fixtures, crane buffers including wooden stoppers, Gable Walkways.
- Floor beams, floor bracing and chqd. plate flooring , lugs in floor beams etc.
- Wind Girders , Side Post .
- Roof trusses, Roof Girders , Monitor trusses, Lighting Walkways, Roof and Monitor bracings, purlins, runners, sag angles ,sag rods.
- Platforms, walkways, handrails.
- Stairs, ladders.
- Gutters and downcomers.

Roof sheeting, Wall sheeting , Approach Stairs to Roof

01.04 GENERAL DESCRIPTION OF STRUCTURES

The following gives only general description of structural work involved in Electrical Repair Shop . The structural work shall not be limited to these but shall be guided by technical/technological aspects for the total scope of work. Overall layout of different unit shall be as per relevant technological drawings.

This is a Single Frame Structural Building having width 12.6 m , length 28 m and Roof height 14.5 m approximately. There will be one EOT Crane (Capacity) Operating in the shop with crane rail height 9.5m.

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Roof shall be covered by GCS sheets up to a height of 5m from below On sides of
The building there shall be translucent sheets to be laid intermittently as per
Drawing.

01.05 INSTRUCTION TO TENDERERS

- 01.05.01 This specification shall be read in conjunction with supplementary documents detailing the work.
- 01.05.02 For quality system inspection and test of Plant and Equipment at manufacturer's premises relevant document shall be referred.
- 01.05.03 The tenderer shall note that supply of raw structural steel plates / sections is under their scope.
- 01.05.04 The entire work under this specification shall be completed within 05 months from the date of placement of order. After award of contract, a final programme shall be prepared well in advance for fabrication / erection dates with approval of the Purchaser.
- 01.05.05 The tenderer shall note, that in case he intends to engage a sub-contractor for a particular work, he shall furnish a list of such probable agencies with their full credentials, for approval of the Purchaser. The engagement of a sub-contractor can be done from only amongst those in the vendor's list of the Purchaser. However the responsibility of the work undertaken by the approved sub-contractor shall fully rest with the principal and main contractor.

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SECTION 02 - FABRICATION OF STEEL STRUCTURES

02.01 SCOPE OF WORK

The scope of work under fabrication includes, but not limited to, the following:

- a) Preparation and supply of material indents, bolt lists bought out items list.
- b) Procurement and supply of all steel materials including loading, transportation, unloading and stacking and storing on skids or supports.
- c) Procurement and collection of all consumables like bolts nuts, washers, electrodes, paints, shims, packs, etc., including allowance for spares and wastage.
- d) Preparation and submission of fabrication drawings, modification /rectification sketches, as made drawings, erection drawings, bill of materials, bolts lists and shipping documents for approval of purchaser.
- e) Preparation of design calculations for non-standard connections, temporary bracings etc. for approval of purchaser.
- f) Cold straightening of section and plates, whenever they are bent and kinked.
- g) Fabrication of all steel structural components covered under tender drawings, design drawings and generally described under the scope of the project.
- h) In case of inability to produce material certificate for the material procured by him, the Contractor has to make arrangements and bear the cost of conducting tests, such as chemical analysis, physical and mechanical tests of raw materials.
- i) Making arrangements and bearing cost for providing all facilities for conducting ultrasonic, X-ray or gamma ray tests of welds; getting the tests conducted by reputed testing laboratories making available test films / graphs, reports and interpretation.
- j) Control Assembly of fabricated structural components at shop, wherever required.
- k) Preparation of steel structural surfaces for painting as provided in the specifications / drawings.
- l) Application for one primer coat of painting at shop, as specified in the design drawing/ specifications.
- m) Loading, transportation from fabrication workshop to site of erection and unloading of all steel structural components / units / assemblies.
- n) Preparation of "As-built" drawings.

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02.02 PREPARATION OF FABRICATION AND ERECTION DRAWINGS

02.02.01 Fabrication drawings shall be prepared based on design drawings of steel structures.

02.02.02 Drawing shall be prepared in metric system as per IS:696-1972 and IS:813-1986. The fabrication drawings shall specify the following details.

- a) Type, size and length of welds in case of welded connections,(specifying clearly shop or site weld). Length of weld specified shall be effective length (excluding end crates).
- b) In case of bolted joints, arrangement of bolts and specification of bolts, nuts etc.(specifying clearly shop and site bolts).
- c) Specification of electrode/wire flux.
- d) If required special provision to be mentioned in the drawings for handling of structures during and after fabrication.
- e) Specification of paint and corresponding surface preparation for painting.
- f) General arrangement/markings plan.
- g) Reference to design drawings.
- h) Material list indicating mark number-wise material requirement giving size, weight, material specification, identification number of each items, number of pieces required etc.
- i) Layout with all connecting members with blown up joint details wherever required, in order to specify clearly various fabrication and erection requirements as per design drawings.
- j) Specification of preparation of mating surfaces in case of connection by HSFG bolts.
- k) Appropriate edge preparation in case of butt/groove welds in accordance with IS:9595-1980, for all plates and sections having thickness greater than 8 mm.
- l) Erection clearances in order to facilitate smooth erection at site (ref clause no.11.2.2.of IS: 800- 1984).
- m) Each erection piece shall be clearly identified by an erection mark in these drawings. All loose members shall be given part mark, which shall be 'wired on' the main erection piece for despatch.

02.02.03 Fabrication drawings shall be prepared in such a manner that structures can be despatched from fabrication shop to erection site with maximum economic transportable size, so as to reduce work involved at site to a minimum.

02.02.04 Bracings shall be connected for 50% of the capacity of the member or the force specified in the design drawing, whichever is more.(for single angle bracing member, consider full area as effective for this purpose).

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- 02.02.05 Standard simple beam connections, unless otherwise stated in the drawings, shall be designed and detailed for 60% beam shear / moment carrying capacity.
- 02.02.06 Wherever there is risk of nuts becoming loose due to vibration, lock nuts shall be provided, or nuts shall be welded after alignment and tightening.
- 02.02.07 For all connections by permanent bolts, two no. of washers shall be used. One washer bearing against the head and the other bearing against the nut.
- 02.02.08 Detailing of structural steel members subject to dynamic loading shall be such as to ensure smooth transition of load, as well as best behavior under stress due to fatigue. Welding across tension flange of crane girders is not permitted.
- 02.02.09 For detailing connection, the allowable stress for materials, welds, bolts etc, shall be as per IS:800- 1984 and IS:816-1969, or as specified in the drawing.
- 02.02.10 The contractor shall be responsible for design and detailing all connections. The design of connection shall provide adequate strength for transfer of force in the structural elements, as indicated on design drawings. Detailing shall be such that erection shall be convenient and free from all interfaces, drilling and cutting at site.

02.03 MATERIALS

- 02.03.01 Structural steel and other related materials for fabrication shall conform to Annexure-A unless stated otherwise.
- 02.03.02 Due to non-availability of specified materials, suitable substitutions may be provided with the consent of the purchaser. Such substitution shall be incorporated in the "As-built" drawings.
- 02.03.03 All the items are to be cut as per requirements of the drawing. If joints are to be provided in any item, in order to meet requirements of size and shape, cutting plan showing locations of joints shall be prepared for consideration of purchaser. Joints provided shall be incorporated in "As-built" drawings.
- 02.03.04 Rolling and cutting tolerances shall be as per IS:1852:1985.
- 02.03.05 If test certificate for the material is not available from the main producer, the tests for Chemical Composition, Mechanical Properties, Weldability shall be carried out at the cost of the Contractor.
- 02.03.06 Before taking up fabrication of heavy sections (built-up sections made of thick plates and heavy rolled sections), the contractor should test the material with respect of cracks, undulations, laminations, cleavages etc. and reject it if faulty. If such fault is detected afterwards, the Contractor has to replace the structure at his own cost.
- 02.03.07 Where steel castings are to be used the same shall conform to IS: 1030:1989.
- 02.03.08 Only tested materials shall be used. Manufacturer's test certificate, including chemical analysis shall be supplied.

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02.04 STORING OF MATERIALS

02.04.01 Materials shall be stored and stacked properly ensuring that place is properly drained and is free from dirt. It shall be ensured that no damage is caused due to improper stacking.

02.05 MATERIAL PREPARATION

02.04.02 Cut edges shall be finished smooth by grinding or machining wherever necessary. Sufficient allowance (3 mm to 5 mm) should be kept in the items incase machining is necessary.

02.04.03 Cutting may be effected by gas cutting, shearing, cropping or sawing. In gas cutting of high tensile steel, special care is to be taken to leave sufficient metal to be removed by machining so that all metal that has been hardened by flame is removed.

02.04.04 Sufficient shrinkage allowance (@ 1mm/M) shall be kept wherever heavy welding is involved.

02.04.05 Straightening and bending shall be done in cold condition as far as practicable.

02.04.06 If required, straightening and bending may be done by application of heat between 900°C and 1100°C. Cooling down of the heated item shall be done slowly.

02.04.07 Rails shall be free from twist, pittings, laminations and other internal or external defects. The rail shall be straight and the deviation from straightness shall not exceed +1.5 mm. If necessary, the rails shall be cold straightened.

02.06 DRILLING AND PUNCHING OF HOLES

02.06.01 Drilling and punching of holes for bolts shall be done as per clause no.11.2.4 of IS:800:1984, unless otherwise specified by the purchaser.

02.06.02 Drifting of holes for bolts during assembly shall not cause enlargement of holes beyond permissible limit or damage the metal.

02.06.03 Holes for bolted connection should match well to permit easy entry of bolts. Gross mismatch of holes shall be avoided.

02.06.04 Permissible deviation in holes for mild steel bolts of normal accuracy and high strength bolts are given in the Annexure-B.

02.07 ASSEMBLY FOR FABRICATION

02.07.01 Fabrication of all structural steelwork shall be in accordance with IS:800-1984 and in conformity with various clauses of this specification, unless otherwise specified in the drawings.

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- 02.07.02 Fabrication of structures shall preferably be taken up as per the sequence of erection.
- 02.07.03 All erection units shall bear erection mark no. and reference drg no. at a prominent location on the structures for easy identification at site.
- 02.07.04 Fabricated structures shall conform to tolerance as specified in this standard and in IS:7215-1974. In case of contradiction, tolerances specified in this standard shall prevail.
- 02.07.05 All the components of structures shall be free from twist, bend, damage etc.
- 02.07.06 Assembly of structures shall be carried out by using suitable jigs and fixtures in order to obviate distortion during welding.
- 02.07.07 Cutting of items specially for truss, bracing, bunker, hopper, galleries surge girder, portal etc, shall be done only after checking of sizes as per Layout.
- 02.07.08 Surface, wherever machining is specified, shall be either planed or milled or ground to ensure maximum contact.
- 02.07.09 If end-milling or machining is planned after the assembly is over, sufficient allowance (5 mm to 15 mm) shall be kept in the items where milling/machining is to be done.
- 02.07.10 If pre-bending of the plate is required to avoid welding distortion, it shall be done in cold condition.
- 02.07.11 If extra joints are required to be provided in column, crane girder etc, approval should be obtained from the purchaser. However, as general guidance following is suggested. Splice joints of column and crane girder shall of full strength butt weld and wherever possible shall be located at zones of minimum or substantially lesser stress.
- 02.07.12 Splice joints of flange and web should preferably be staggered.
- 02.07.13 Sufficient trial assembly of fabricated components (despatch elements) shall be carried out in the fabrication works to control the accuracy of workmanship.
- 02.07.14 Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads of nuts and bolts satisfactory bearing.
- 02.07.15 The threaded portion of each bolt shall project through the nut at least by one thread.
- 02.07.16 Tolerance of assembled components of structures are given in Annexure-C.
- 02.07.17 Permissible deviations from designed (true) geometrical form of the despatch elements shall be in accordance with IS:7215-1974.

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02.08 ACCEPTANCE STANDARD OF WELDING, PAINTING AND SURFACE PREPARATION

- 02.08.01 All welding work should conform to drawings and the section on “Welding of Steel Structures” of this specification.
- 02.08.02 All surface preparation and painting work should conform to drawings and the section on “Surface Preparation and Painting of Steel Structures” of this specification.

02.09 INSPECTION & TESTING

- 02.09.01 The purchaser/Inspector shall have free access at all times to those parts of Contractor's or his Sub- Contractor's works which are concerned with the fabrication of steel works. Also he shall be provided all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of relevant specification.
- 02.09.02 All gauges and templates, tools, apparatus, labour and assistance for checking shall be supplied by the contractor free of charge. The purchaser /Inspector may at his discretion, check the test results obtained at the Contractor's works, by independent test at the Government Test House or elsewhere, and should the material so tested be found to be unsatisfactory, the cost of such such test shall be borne by the Contractor.
- 02.09.03 Contractor shall make all necessary arrangements for stage inspection by purchaser/Inspector during the fabrication at shop and incorporate all on-the-spot instructions / changes conveyed in writing to the Contractor.
- 02.09.04 Material improperly detailed or wrongly fabricated shall be reported to the Purchaser/Inspector and shall be made good as directed. Minor misfits which can be remedied by moderate use of drift pins, and moderate amount of reaming and slight chipping may be corrected in that manner, if in the opinion of the Purchaser/Inspector the strength or appearance of the structure will not be adversely affected. In the event the Purchaser/Inspector directs otherwise, the items will be rejected and a completely new piece shall be fabricated. The cost of correcting errors shall be to the account of the Contractor.
- 02.09.05 The Purchaser/Inspector shall have the power:
- To certify, before any structure is submitted for inspection, that the same is not in accordance with the contract, owing to the adoption of any unsatisfactory method of fabrication.
 - To reject any structure as not being in accordance with specifications & drawings.
 - To insist that no structure or parts of the structure once rejected is resubmitted for inspection/ test, except in cases where the Purchaser / Inspector/ authorised representative considers the defects as rectifiable.

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- 02.09.06 If, on rejection of structure by the Purchaser/Inspector the Contractor fails to make satisfactory progress within the stipulated period, the Purchaser/Inspector shall be at liberty to cancel the contract and fabricate or authorise the fabrication of the structures at any other place he chooses, at the risk and cost of the Contractor, without prejudice to any action being taken in addition to terms of General Conditions of Contract.
- 02.09.07 The Purchaser / Inspector's decision regarding rejection shall be final and binding on the Contractor.
- 02.09.08 The specifications prescribe various tests at specified intervals for ascertaining the quality of the work done. If the tests prove unsatisfactory, Purchaser/Inspector shall have liberty to order the Contractor to re-do the work, done in that period and/ or to order such alterations and strengthening that may be necessary at the cost of the Contractor. The contractor shall be bound to carryout such orders failing which the rectification/re-doing will be done by the Purchaser through other agencies and the cost recovered from the Contractor.
- 02.09.09 Notwithstanding any inspection at the workshop the Purchaser/Inspector shall have the liberty to reject, without being liable for compensation any fabricated members or materials brought to site that do not conform to specifications / drawings.
- 02.09.10 If material is supplied free of cost by Client and a structure is rejected after fabrication or lost or stolen, the contractor has to pay the cost of material to the Client.
- 02.09.11 All rejected materials shall be removed from the site of fabrication by the Contractor at his own cost and within the time stipulated by the Purchaser/Inspector.

02.10 ACCEPTANCE CRITERIA OF PLANED/ MACHINED SURFACE

- 02.10.01 Standard of acceptance for planed/ machined surfaces, wherever specified by designer, (eg. in end bearing plates of crane girders, base plates and column shafts etc.) shall be as given as per following clauses unless otherwise stated in drawings.
- 02.10.02 Maximum surface unevenness on bearing surface of cap/ base plate shall not exceed 0.5 mm.
- 02.10.03 When assembled, there must be physical contact for atleast 75% of the contact surface.(The checking shall be carried out with 0.2mm gauge . Care should be taken that these connecting members are fixed with such accuracy that they are not reduced in thickness during machining by more than 1.0 mm.

02.11 DESPATCH INSTRUCTIONS

- 02.11.01 Each despatchable structure shall bear mark no. along with reference drawing number at two prominent locations (e.g. on flange and bottom of base plate of a column).

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- 02.11.02 "As built" drawing shall be prepared after fabrication is completed to indicate additions / alterations made during the process of fabrication.
- 02.11.03 Control assembly of important structures shall be done in the shop floor before despatch to avoid mismatching. For all such important structures, match marking shall be given at the control assembly stage in the shop floor and such match markings shall be made clearly visible while assembling the structures at site.
- 02.11.04 Centre lines of column flanges and both sides of web shall be punched, preferably at top and bottom to facilitate alignment after erection.

02.12 COMPLETION DOCUMENTS

- 02.12.01 On completion of work, the Contractor shall submit to the Purchaser the following documents.
- The technical documents according to which the work was carried out.
 - Copies of the "As built" drawings showing thereon all additions and alterations made during the fabrication.
 - Manufacturer's test certificates.
 - Certificates/documents on control checking.
 - Test of welds
- 02.12.02 The Purchaser/Inspector shall issue inspection Certificates to the contractor for the structures found acceptable.

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SECTION 03 - ERECTION OF STEEL STRUCTURES

03.01 SCOPE OF WORK

The scope of work under fabrication includes, but not limited to, the following:

- a) Supply of tools and tackles, consumables, materials, labour and supervision.
- b) Storing and stacking of all fabricated structural components/units/assemblies at site storage yards till the time of erection. The contractor has to undertake the enabling works for transportation of fabricated structures, man and machine.
- c) Transportation of structures from storage yard to site of erection, including multiple handling, if required.
- d) Execution of all minor rectification / modifications.
- e) Removal of bends, kinks, twists etc. for parts damaged during transportation and handling.
- f) Reaming of holes which do not register or which are damaged, for use of next higher size bolt.
- g) Plug-welding and re-drilling of holes which do not register and which cannot be reamed for use of next higher size bolt.
- h) Drilling of holes which are either not drilled at all or are drilled in incorrect position during fabrication.
- i) Fabrication of minor missing items as directed by the purchaser.
- j) Verification of the position of embedded anchor bolts and inserts with respect to benchmarks/ based on Geodetic Scheme.
- k) Assembly at site of steel Structural components wherever required, including temporary supports and staging.
- l) Making arrangements and bearing cost for providing all facilities for conducting ultrasonic, X-ray or gamma ray tests of welds; getting the tests conducted by reputed testing laboratories making available test films / graphs, reports and interpretation.
- m) Rectification at site damaged portions of shop primer by cleaning and application of primer and touch-up paint.
- n) Erection of structures including making connections by bolts / High strength Friction Grip bolts/welding as per drawing.
- o) Alignment of all structures true to line, level plumb and dimensions within specified limits of tolerance.

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- p) Grouting of the gap between base plate and top of foundation with concrete of approved quality and specification after total alignment.
- q) Application at site after erection, required number of coats of primer and finishing paint as per specification and drawing.
- r) Rectification of structures as per Preliminary acceptance report and Final acceptance report.
- s) Cleaning of all structural scraps or other materials accumulated during the course of construction.

03.02 STORAGE AND HANDLING

- 03.02.01 Storage of structures shall be preferably be done in such a manner that erection sequence is not affected.
- 03.02.02 While storing, care shall be taken so that structures do not come in direct contact with the earth surface and accumulated water. Girders, beams, columns. shall be placed and stored in such a manner that during rain, no accumulation of water on the structures takes place.
- 03.02.03 Stacking of the structures shall be done in such a way that, erection marks are visible easily and handling does not become difficult. Wherever required, wooden sleepers / grilles may be used.
- 03.02.04 Handling and storage of materials shall be as per IS:7969-1975, to ensure safety.

03.03 INSTRUCTIONS FOR ERECTION

- 03.03.01 Erection shall be carried out in accordance with IS:800:1984 and other relevant standards referred to therein.
- 03.03.02 Materials shall conform to Annexure – A unless stated otherwise.
- 03.03.03 For safe and accurate erection of structural steelwork, staging, temporary support, false-work etc. shall be erected as required.
- 03.03.04 The fabricated materials received at erection site shall be verified with respect of marking on the key plan/marketing plan or shipping list.
- 03.03.05 Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be painted in distinct colour for identification and the same shall be brought to the notice of the Purchaser.
- 03.03.06 The approved erection drawings and any approved arrangement drg, specification or instruction accompanying them shall be followed in erecting structures.
- 03.03.07 Erection work shall be taken up after receipt of clearance from the purchaser.
- 03.03.08 For safety requirements during erection, provisions in IS:7205:1974, IS:7969:1975 and other relevant Indian standards shall be followed.

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- 03.03.09 Erection shall be carried out with the help of maximum mechanisation possible.
- 03.03.10 Prior to commencement of erection, all the erection equipment, tools, tackles, ropes etc. shall be tested for their load carrying capacity. Such tests may be repeated at intermediate stages also if considered necessary and frequent visual inspection shall be done of all vulnerable areas and components to detect damages or distress in the erection equipment, if any.
- 03.03.11 Temporary bracing, whenever required, shall be provided to sustain forces due to erection loads and equipment etc. Erected parts of the structures shall remain stable during all stages of erection when subjected to the action of wind, dead weight and erection forces etc. Specified sequence of erection of vertical and horizontal structural members shall be followed.
- 03.03.12 Erected members shall be held securely in place by bolts to take care of dead load, wind load and erection load.
- 03.03.13 All connections shall achieve free expansion and contraction of structures wherever provided.
- 03.03.14 No final bolting or welding of joints shall be done until the structure has been properly aligned.
- 03.03.15 For positioning beams, columns and other steel members, the use of steel sledges is not permitted.
- 03.03.16 Instrumental checking of correctness of initial setting out of structures and adjustment of alignment shall be carried out in sequence and at different stages as required. The final leveling and alignment shall be carried out immediately after completion of each section of a building.
- 03.03.17 All structural members shall be erected with erection marks in the same relative position as shown in the appropriate erection and shop drawings.
- 03.03.18 The contractor shall design, manufacture, erect and provide false-work, staging temporary support etc. required for safe and accurate erection of structural steelwork and shall be fully responsible for the adequacy of the same.
- 03.03.19 The Contractor shall also provide facilities such as adequate temporary access ladders, gangways, tools & tackles, instruments etc. to purchaser for his inspection at any stage during erection.
- 03.03.20 The contractor shall fully abide by the safety procedures and any accident whatsoever concerned to erection shall be full responsibility of the contractor.

03.04 FIELD CONNECTIONS

- 03.04.01 The numbers of washers on permanent bolts shall be one for the bolt head side and one or two for the nut side.
- 03.04.02 Where bolting is specified on the drawing, the bolts shall be tightened to the maximum limit. The threaded portion of the each bolt shall be project through the

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nut by at-least one thread. Tapered washers shall be provided for all heads and nuts to achieve uniform bearing on sloping surface.

- 03.04.03 To prevent loosening of nuts, spring washers or lock- nuts shall be provided and for proper bearing tapered washers to be provided as per instructions / drawings.
- 03.04.04 All machine-fitted bolts shall be perfectly tight and the ends shall be checked to prevent nuts from becoming loose. No unfilled holes shall be left in any part of the structures.
- 03.04.05 All field assembly by welding shall be executed in accordance with the requirements for shop fabrication. Where the steel has been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joints to be welded.
- 03.04.06 Assembly of structures with High Strength Friction Grip (HSFG) bolts shall conform to IS: 4000-1992.
- 03.04.07 The mating surfaces shall be prepared in accordance with the requirements of design in order to achieve required properties to develop adequate friction between the surfaces.
- 03.04.08 The mating surfaces shall be absolutely free from grease, lubricant, dust, rust etc. and shall be thoroughly cleaned before assembly.
- 03.04.09 The nuts shall be tightened up-to the specified torque with the help of torque -wrench or by half- turn method with the help of pneumatic wrench lever.
- 03.04.10 The direction of tightening of the nuts shall be from the middle toward the periphery of assembly.
- 03.04.11 After desired tightening the bolt heads, nuts and edges of the mating surfaces shall be sealed with a coat of paint to obviate entry of moisture.

03.05 ACCEPTANCE STANDARD OF WELDING

- 03.05.01 Acceptance standard of welding shall conform to as specified under the section "Welding of Structures" of this specification.

03.06 BEDDING AND GROUTING

- 03.06.01 Base plates shall be set to elevations shown on the drawings, supported aligned and leveled using steel wedges, pack plates and shims or by other approved methods. Plates shall be leveled properly, positioned and the anchor bolts tightened.
- 03.06.02 Pack plates below base plate should cover at least 50% area of the base plate unless noted otherwise and all such material shall be provided by the contractor.
- 03.06.03 The gap between the base plate and the foundation shall be pressure grouted by approved method, after thorough cleaning of the gap, duly checked by site

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engineer. The concrete mix shall be minimum M20 or as per instruction / drawings and to be supplied by the contractor. Such grouting to be carried out strictly under the supervision of site engineer.

03.06.04 Bedding/ grouting shall be carried out until sufficient number of columns have been properly aligned, leveled and plumbed and sufficient number of girders, beams, trusses and bracings have been put in position to the satisfaction of purchaser.

03.07 CRANE RAIL JOINTS

03.07.01 The crane rail joints shall be butt-jointed (either by thermit or fusion welding) or by fish plates as per specification/ drawings.

03.07.02 For butt-welding, the Contractor shall take prior approval of the purchaser regarding method of edge preparation, welding procedure and sequence of welding to be done. Edge preparation shall be done by oxy- acetylene flame and shall be neatly finished by chipping and grinding.

03.07.03 All position low hydrogen electrode conforming to IS:814-1991 shall be used for welding. The rail ends shall be preheated to 250`C before welding .The electrode shall be preheated as per manufacturer's instructions. The welded joint shall be allowed to cool slowly. It is recommended that the initial and intermediate layers of deposits may be built by using Ferron V, super chord or equivalent. Top 3 mm layer shall be deposited with Duroid 2A or equivalent, to obtain good wearing surface.

03.07.04 The joints shall be free from kinks, twists etc. and shall be ground properly after welding to ensure smooth running of the crane.

03.08 PAINTING AFTER ERECTION

03.08.01 The surface preparation and painting shall be carried out as stated in the section "Surface Preparation and Painting of Steel Structures" of this specification.

03.09 ERECTION TOLERANCES

03.09.01 Maximum permissible tolerances in erected steel structures shall be as given in Annexure-E.

03.10 ACCEPTANCE OF WORK

03.10.01 Acceptance of erected steel structures shall be either after completion of erection of the whole building or in blocks.

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03.11 DOCUMENTATION

03.11.01 The following documents shall be prepared at the time of acceptance of erected structures.

- a) Documents showing actual deviations made during execution of erection work and approval of competent authority.
- b) Documents showing acceptance of embedded structures.
- c) Certificates /documents on control checking and test of materials (if any) and weld.
- d) Data and result of geodetic measurements obtained while checking the erection of the structures.
- e) Copies of "As-Built" drawing showing thereon all additions and alternations, which took place between approval of drawing and erection of structures.

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SECTION 04 - WELDING OF STEEL STRUCTURES

04.01 GENERAL INSTRUCTIONS

04.01.01 The Contractor shall work out welding procedure at his own responsibility for Purchaser's approval, considering the following factors.

- a) Specification and thickness of steel.
- b) Specification of electrode or/and base wire.
- c) Welding process (manual arc welding, submerged arc welding).
- d) Type of structures to be welded (thickness of components meeting at a joint).
- e) Pre and post heating requirement.
- f) Preparation of fusion faces.
- g) Sequence of welding.
- h) Weather condition.
- i) Use of jigs and fixtures etc.
- j) Type of non-destructive testing to be carried out.
- k) Inspection procedure to be followed.
- l) Design requirements of the joints.

04.01.02 Welding of any load bearing structure shall be carried out only by the person who has passed welder's qualification as per IS:7318 (Part-I)-1974.

04.01.03 All metal arc welding shall be carried out as per IS:9595-1980.

04.01.04 Submerged arc welding of mild steel and low alloy steel shall be as per IS:4353-1967.

04.01.05 Electrode shall conform to as specified in Annexure- A of this specification, unless stated otherwise.

04.01.06 Electrodes shall be stored in a dry place. Electrodes whose coatings are damaged due to absorption of moisture or due any other reason shall not be used.

04.01.07 Low Hydrogen electrodes and flux for submerged welding shall be dried at 250°-300° C for one hour in drying oven before use.

04.01.08 For suitability of wire flux combination, procedure test shall be carried out as per IS:3613-1974 if so required.

04.01.09 Welding shall be done by electric arc process. Generally submerged arc, automatic & Semi-automatic welding shall be employed. Only where it is not practicable,

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manual arc welding may be resorted to. In case of manual arc welding, recommendations of electrode manufacturer are to be strictly followed.

- 04.01.10 Welding surface shall be smooth, uniform, and free from fins, tears notches or any other defect, which may adversely affect welding.
- 04.01.11 For multi-run weld deposit, the next run should be done only after thorough removal of slag and proper cleaning of surface.
- 04.01.12 Fillet weld shall have the correct profile with smooth transition into parent metal. Dressing of welds, if specified, shall be done by such method, which does not cause grooving and other surface defects on the weld or on the parent metal.
- 04.01.13 All butt welds shall start and end with run-on and run-off plates. All such plates shall be carefully trimmed off by gas cutting after welding is over.
- 04.01.14 Fillet welds shall not be stopped at corners but shall be returned round them.
- 04.01.15 If butt weld is to be ground flush with the surface of the member as per drawing. Adequate reinforcement shall be built up and then the same shall be chipped off and ground flush. The grinding is to be done in the direction of stress flow till the transverse marks are eliminated.
- 04.01.16 Welding shall not be done under such weather conditions, which might adversely affect the efficiency of the welding.
- 04.01.17 Manipulators shall be used wherever necessary and shall be designed to facilitate welding and ensure that all welds are easily accessible to the operators.
- 04.01.18 Stress relieving after welding shall be done if especially called for in the drawing or specification. Ends of structural members and portions of gussets receiving welding at site shall be left unpainted.
- 04.01.19 Permissible deviation in assembly of weld joints shall be in accordance with Annexure- D.

04.02 CONTROL IN WELDING

- 04.02.01 The extent of quality control in respect of welds for structural elements for both statically and dynamically loaded structures shall be as follows and shall be conducted by the contractor at his own cost. Before inspection, the surface of weld metal shall be cleaned of all slag, spatter matter, scales etc. by using wire brush or chisel.
 - a) Visual Examination - All welds shall be 100% visually inspected to check the following like presence of undercuts, visually identifiable surface cracks in both welds and base metals, unfilled craters, improper weld profile and size, excessive reinforcement in weld, surface porosity.
 - b) Dye Penetration Test (DPT) - This shall be carried out in accordance with American National Standard ASTM E165 for all important fillet welds and groove

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welds for both statically and dynamically loaded structures to check the following like surface cracks, surface porosity.

c) Ultrasonic testing

Ultrasonic test shall be conducted for all groove welds and heat affected zone in dynamically loaded structures and for other important load bearing butt welds in statically loaded structures as desired by purchaser, to detect the following like Cracks, Lack of fusion, Slag inclusions, Gas porosity

Ultrasonic testing shall be carried out in accordance with American National Standard ANSI/AWS D1.1-96 Chapter -6: Part F.

Before ultrasonic test is carried out, any surface irregularity like undercuts, sharp ridges etc. shall be rectified. Material surface to be used for scanning by probes must allow free movement of probes. For this purpose, surface shall be prepared to make it suitable for carrying out ultrasonic examination.

d) Radiographic Testing (X-ray and Gamma-Ray Examination)

This test shall be limited to 2% of length of welds for welds made by manual or semi- automatic welding and 1 % of length of weld if made by automatic welding machines. The location and extent of weld to be tested by this method shall be decided by purchaser to detect the following defects like gas porosity, slag inclusions, lack of penetration, lack of fusion, cracks.

Radiographic testing shall be conducted in accordance with American National Standard ANSI/AWS D1.1-96 Part E.

Any surface irregularity like undercuts, craters, pits etc. shall be removed before conducting radiographic test. The length of weld to be tested shall not be more than $0.75 \times$ focal distance. The width of the radiographic film shall be width of the welded joint plus 20 mm on either side of the weld.

04.03 ACCEPTABLE LIMITS OF DEFECTS IN WELD

04.03.01 Limits of Acceptability of welding defects shall be as follows.

- a) Visual inspection & Dye Penetration Test - The limits of acceptability of defects detected during visual inspection and Dye Penetration Test shall be in accordance with clauses 6.9 & clause 6.10 of American National Standard ANSI/AWS D1.1-96 for statically as well as dynamically loaded structures respectively.
- b) Ultrasonic Testing - The limits of acceptability of defects detected during ultrasonic testing shall be in accordance with clause 6.13.1 & clause 6.13.2 of American National Standard ANSI/AWS D1.1-96 Chapter 6: Part C for statically and dynamically loaded structures respectively.
- c) Radiographic testing - The limits of acceptability of defects detected during Radiographic testing shall be in accordance with clauses 6.12.1 & 6.12.2 of

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American National Standard ANSI/AWS D1.1-96 Chapter 6 : Part C for statically and dynamically loaded structures respectively.

04.04 RECTIFICATION OF DEFECTS IN WELDS

04.04.01 In case of detection of defects in welds, the rectification of the same shall be done as follows.

- a) All craters in the weld and breaks in the weld run shall be thoroughly filled with weld.
- b) Undercuts, beyond acceptable limits, shall be repaired with dressing so as to provide smooth transition of weld to parent metal.
- c) Welds with cracks and also welds with incomplete penetration, porosity, slag inclusion etc. exceeding permissible limits shall be rectified by removing the length of weld at the location of such defects plus 10 mm from both ends of defective weld, and shall be re-welded. Defective weld shall be removed by chipping hammer, gouging torch or grinding wheel. Care shall be taken not to damage the adjacent material.

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SECTION 05 – SURFACE PREPARATION AND PAINTING OF STEEL STRUCTURES

05.01 SURFACE PREPARATION FOR PAINTING

- 05.01.01 The steel surface which is to be prepared shall be cleaned of dirt and grease and the heavier layers of rust shall be removed by grinding prior to actual surface preparation to a specified grade.
- 05.01.02 Surface preparation to be followed prior to painting shall be based on the requirement of a particular painting system adopted. One of the following specifications for surface preparation is to be followed as per requirement.

05.02 GRADES OF MECHANICAL CLEANING

- 05.02.01 Mechanical cleaning shall be done manually or using power as per grade St-2 or St-3 of Swedish Standard Institution SIS 055900.
- a) Grade St-2: Thorough scraping and wire brushing, machine brushing, grinding etc. This grade of preparation shall remove loose mill scale, rust and foreign matter. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or with clean brush. After preparation, the surface should have a faint metallic sheen. The appearance shall correspond to the prints designated St-2.
 - b) Grade St-3: very thorough scraping and wire brushing, machine brushing, grinding etc. The surface preparation is same as for grade St-2 but to be done much more thoroughly. After preparing the surface, it should have a pronounced metallic sheen and correspond to the prints designated St-3.
- 05.02.02 If no grade of surface preparation is specified, Grade St-2 as specified above shall be followed.

05.03 GRADES OF BLAST CLEANING

- 05.03.01 Blast cleaning shall be done by sand blasting or shot blasting as per following grades according to Swedish Standard SIS 055900.
- a) Grade Sa-2: This involves light blast cleaning. Almost all mill scale, rust and foreign matter shall be removed. Finally the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. The surface shall look grayish in colour and correspond in appearance to the prints designated as Sa-2.
 - b) Grade Sa-2½: This involves very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remain in the form of slight stains. Finally the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It shall then correspond in appearance to the prints designated as Sa 2½.

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- c) Grade Sa-3: This involves blast cleaning to pure metal surface. Mill scale, rust and foreign matter shall be removed completely. Finally the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. Then the surface shall have a uniform metallic colour in appearance and correspond to the print designated as Sa-3.

05.04 SAND BLASTING

- 05.04.01 The sand used for sand blasting shall contain not less than 94% SiO₂. Dried sand with moisture content not exceeding 2% shall be used. Sand shall be sharp clean and free from clay and other deleterious materials (Grain size 0.6mm-2mm). After sand blasting the surfaces shall have appearance as mentioned in the grade of surface preparation.
- 05.04.02 Sand blasting shall be done with the help of compressed air at a gauge pressure of approx. 3 kg/cm². The blasting nozzle shall be held not more than 20 to 30 cm from the surface being cleaned and the angle between the nozzle and the surface shall be around 75°.
- 05.04.03 The compressed air to be used for sand blasting shall be clean of all traces of oil and water by passing it through an oil and water separator. To check that the air blast is free of oil and water, its stream shall be directed towards a sheet of white filter paper, which should not develop any spot of oil or water after a period of minimum 30 seconds. This check on the satisfactory working of oil and water separator must be carried out before start of every shift.

05.05 SHOT BLAST CLEANING

- 05.05.01 In this process, abrasive particles are directed at high velocity against the metal surface through compressed air or high-pressure water thrown by centrifugal force from an impeller wheel. The abrasives used are chilled iron grit, cut steel wire, copper/iron slag etc. The procedure of shot blasting shall be as per relevant Indian Standards.

05.06 FLAME CLEANING

- 05.06.01 Flame cleaning shall also be carried out with the help of a special oxy-acetylene torch and the loosened mill scale shall be removed with a wire brush. This process is not recommended for cleaning steel sheet or plates less than 6 mm in thickness as it may lead to buckling. The number of flame passes on such surface shall be limited to three. The primer coat of paint shall be applied when the surface is still warm, after removing the scales with brushing and wiping.

05.07 GENERAL INSTRUCTIONS FOR PAINTS AND PAINTING

- 05.07.01 For use of specific painting system, the paint manufacturer's specification shall prevail.

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- 05.07.02 General compatibility between primer and finishing paints shall be established through the paint manufacturer supplying the paints.
- 05.07.03 Before buying the paint in bulk, it is recommended to obtain sample of paint and establish "Control Area of Painting". On control area surface preparation and painting shall be carried out in the presence of manufacturer of paint.
- 05.07.04 In order to ensure that the supplied paint meets the stipulation in design drawing/ specification, if required, samples of paint shall be tested in laboratories to establish quality of paint with respect to (i) viscosity (ii) adhesion/ bond of paint in steel surfaces (iii) adhesion/simulated salt spray test (iv) chemical analysis (percentage of solids by weight) (v) normal wear resistance as encountered during handling & erection (vi) resistance against exposure to acid fumes etc. Whole quantity of paint for a particular system of paint shall be obtained from the same manufacturer.
- 05.07.05 Thinners, wherever used, shall be as per recommendation of the paint manufacturer.
- 05.07.06 Areas, which become inaccessible after assembly of structures shall be painted before assembly, after cleaning the surfaces as specified.
- 05.07.07 Wherever shop primer painting is scratched, abraded or damaged, the surfaces shall be thoroughly cleaned using emery paper and power driven wire brush wherever warranted, and touched up with corresponding primer. Touching up paint shall be matched and blended to eliminate conspicuous marks.
- 05.07.08 If more than 50% of the painted surface of an item requires repair, the entire item shall be mechanically cleaned and new primer coats shall be applied followed by finishing coats as per painting specification.
- 05.07.09 All field-welded areas on shop painted item shall be mechanically cleaned (including the weld area proper, adjacent areas contaminated by weld spatter or fumes and areas where existing primer. intermediate / finishing paint is burnt). Subsequently, new primer and finishing coats of paint shall be applied as per painting specification.
- 05.07.10 Application of paint shall be by spraying or brushing as per IS:487-1985 and in uniform layers of 50% overlapping strokes. Painting shall not be done when the temperature is less than 5°C or relative humidity more than 85%, unless manufacturer's recommendations permit. Also painting shall not be done in frosty or foggy weather. During application, paint agitation must be provided wherever such agitation is recommended by the manufacturer.
- 05.07.11 Paint shall be applied at manufacturer's recommended rates. The number of coats shall be such that the minimum dry film thickness (DFT) specified is achieved. The dry film thickness of painted surfaces shall be checked with Elcometer or measuring gauges to ensure application of specified DFT.
- 05.07.12 All structures shall receive appropriate number of primer and finishing coats in order to achieve overall DFT as per design drawings/ specifications. First coat of primer paint shall be applied not later than 2-3 hours after preparation of surface, unless specified otherwise.

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- 05.07.13 The finishing paint as specified shall be of approved colour and quality. The under coat shall have different tint to distinguish the same from the finishing coat.
- 05.07.14 Edges, corners, crevices, depressions, joints and welds shall receive special attention to ensure that they receive painting coats of the required thickness.
- 05.07.15 Machine-finished surface shall be coated with white lead and tallow before shipment or before being put into the open air.
- 05.07.16 Parts of surfaces embedded in concrete shall be thoroughly cleaned of grease, rust, mill scale etc. and shall be given a protective coat of portland cement slurry immediately after fabrication. No paint shall be applied on this part.
- 05.07.17 Zinc-rich primer paints, which have been exposed several months before finishing coat is applied, shall be washed down thoroughly to remove soluble zinc salt deposits. In similar circumstances, the surfaces of paint based on epoxy resin should be abraded or lightly blast cleaned to ensure adhesion of next coat.
- 05.07.18 Surfaces which cannot be painted but require protection shall be given a coat of rust inhibitive grease according to IS:958-1975 or equivalent international standard.

05.08 PAINTING SYSTEM

The recommended painting system for general service requirement of steel structures covering surface preparation, application of primer coats, intermediate coats (if necessary) and final coats to develop the required minimum dry film thickness on steel surface is indicated below.

CHOICE OF PAINTING SYSTEM

1. PAINT SYSTEM-P1 (General service paint without intermediate coat, for Inland structures without corrosive chemical environment).

- i) Surface preparation: -St-2 according to Swedish Standard SIS055900.
- ii) Primer paint: - Two coats of zinc phosphate in phenolic alkyd medium (DFT = 35 microns/coat).
- iii) Finishing paint :- Two coats of synthetic enamel (DFT=25 microns/coat) conforming to IS:2932 -1974.

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SECTION 06 – CLADDING OF BUILDINGS WITH SHEETS

06.01 SCOPE OF WORK

06.01.01 The scope of work shall cover:

- a) Preparation of drawings showing layout and size of sheets used, details of connections and flashings, bill materials.
- b) Procurement and supply sheets of all gauges and sizes, flashings and fittings like corner pieces, apron pieces, ridges, cutting and bending of sheets wherever required; drilling of holes all as per specification and drawings.
- c) Procurement and supply of GI hook bolts and nuts, GI stich bolts and nuts, clips, bitumen washers, GI diamond or limpet washers.
- d) Loading, transportation, unloading and delivery of sheeting material from place of procurement to erection site.
- e) Provision of all tools, tackles, equipment, labour supervision and services required for the satisfactory completion of the work specified herein and on the drawings.
- f) Erection in position sheets for roofing, walling, louvres; erection of all flashings, fittings like ridges, valleys, gutters, corners, apron etc. at all locations all work as per drawings and specifications.
- g) All necessary galvanised flashings, ridging, capping, gable and corner trimming shall be made from galvanised plain sheets in line with the gauge of roof/side covering where it is used. Where connection between two different gauge sheetings is involved thickness corresponding to lower gauge may be used.
- h) Suitable Wind Ties (galvanised steel flats) shall be provided after fixing of sheets, at the free edge of sheeting.
- i) Steelwork coming in direct contact with aluminium sheets shall be treated with two coats of zinc based primer and one coat of aluminium paint as topping coat.

06.02 MATERIAL

06.02.01 All cladding sheets and other related materials shall conform to Annexure-A unless stated otherwise.

06.03 FIXING OF SHEETS

06.03.01 Sheets to be fixed as per this specification in case of non-availability of drawings.

06.03.02 All fixing of the roof and side sheeting to purlins shall be by means of 8 mm dia galvanised hook bolts and clips. All fixing accessories shall conform to IS:730-1978.

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- 06.03.03 All bolts shall pass through the crown of the corrugations for roof sheets and through trough corrugations for side sheets. GCS sheets are to be provided with galvanised steel diamond or limpet washer over bituminous felt washer. Aluminium sheets shall be provided with aluminium curved / flat washers over neoprene / bituminous felt washers. Fixing too the purlins shall be provided through at least every fourth corrugation for GCS sheets. Hook bolts shall be placed at a maximum of 3 pitches apart for troughed aluminium sheets.
- 06.03.04 All sheets shall be stitched together by 6 mm dia. galvanised screw and nuts at 300 mm centres. In case of double side lap the pitch has to be staggered between alternative crowns. A steel washer and bitumen felt washer is to be provided under the head of the screw which shall always be on the outside the building.
- 06.03.05 All holes for sheetings and flashings are to be drilled at site with electric drill from the bottom side of the crown. The method of drilling shall be such that the material fits snugly together at laps to allow washers to have a good seating.
- 06.03.06 All roofing shall be provided with one and a half corrugation side lap and 230 mm end lap for roof slopes 15 ° and below. For roof slopes above 15° end laps may be reduced to 150 mm.
- 06.03.07 All side/gable end sheets shall be provided with single corrugation side lap and 100 mm end lap.
- 06.03.08 Overhang of sheets on the roof and side cladding shall not exceed 300 mm.
- 06.03.09 Erection is to be carried out with the lay of the side laps such that under the prevailing wind, rain is not driven into the lap. The sheets shall be laid so that side laps in any two consecutive rows are staggered.
- 06.03.10 Broken or otherwise damaged sheeting shall not be erected.
- 06.03.11 Cutting, framing and trimming of all openings required shall be carried out at site.
- 06.03.12 For AC sheets all necessary corners and bargeboards shall be out of plain AC sheets and ridge capping shall be made out of the close fitting adjustable AC ridges. Where standard AC fittings are not available, flashings made out of plain GI sheets shall be used.
- 06.03.13 All fixing of the roof and side sheeting to purlins and rails shall be by 8 mm dia. galvanised hook bolts. All bolts are to pass through the crown of the corrugation and are to be provided with GI flat washers and bitumen washers of approved quality.
- 06.03.14 Over hang of the sheets on the roof and side cladding shall not exceed 300 mm.
- 06.03.15 Erection is to be carried out with the lay of the side laps such that under the prevailing wind, rain is not driven into the lap. Laying and fixing of AC sheets shall be as per IS: 3007(Part I)-1964.

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SECTION 07 – SPECIAL CONDITION OF CONTRACT

07.01 QUOTATION

- 07.01.01 The bidder should ascertain himself, by a visit to the site if necessary, the actual site conditions, local factors etc. The Contractor shall bear full responsibility for deductions and conclusions as to the nature and conditions under which the work is to be executed, including effect of climate, rainfall etc. Failure to do so will not absolve the Contractor of his responsibilities about the proper execution of the job. No claims for extra payments due to any special site conditions and ignorance of site conditions will be considered after the acceptance of his quotation.
- 07.01.02 The contractor shall indicate his price as per Schedule of Quantities given in Annexure - F, as applicable.
- 07.01.03 The enclosed bid documents are deemed to be sufficient for the bidder to assess the nature and quantity of work involved and to quote his prices for the above job. No payment on account of deviations from the bid drawings will be admissible.
- 07.01.04 The cost of MS bolts (permanent and erection), washers, electrodes, putty, gases, cost of straightening the raw materials (hot bending not permitted), cutting of flats from plates and providing splices, paints, tool, plants, etc. as required for the work shall be deemed to be included in the quoted price.
- 07.01.05 All handling and transport charges of raw materials and fabricated structures, including double handling if required, for completion of the work in accordance with time schedule are deemed to be included in the quoted price.
- 07.01.06 Cost of NDT of welds as per specification shall be borne by the Contractor. For the welds found defective, the cost of retest shall be borne by the contractor in addition to the cost of rectification or replacement of the defective part.

07.02 DIVISION OF WORK

- 07.02.01 Purchaser shall have the right to divide and award the work in this Invitation to Bid, to more than one Bidder.

07.03 PROGRAMME

- 07.03.01 A monthly time bar chart for various activities like procurement of steel, preparation and approval of fabrication drawings, fabrication, despatch to site, erection and alignment, sheeting and painting etc. giving starting and completion dates of all activities, shall be submitted alongwith the bid without which the bid may not be considered for evaluation.
- 07.03.02 The contractor shall also furnish his overall planning of construction programme, the capacity of equipment he proposes to deploy on various components of work etc. for prior approval of purchaser.

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- 07.03.03 All programmes on procurement of raw steel and other materials, preparation of drawings, fabrication and despatch shall match with the sequence of erection of different structural components and different building/units, of the project as per network planning.
- 07.03.04 The purchaser may change or alter the detailed working programme for the sequence of work and for the fabrication of components of structures, within the frame work of the agreed schedule, which will be binding on the Contractor.
- 07.03.05 If due to design or other stipulations in the bid or requirements at site, a particular sequence of overall construction has to be followed due to which certain interruptions to any one or more items of work are inherent, no claims for such interruption will be admissible.

07.04 DRAWINGS

- 07.04.01 The Contractor will be supplied with..4....copies of design drawings by the Purchaser.
- 07.04.02 Based on the design drawings, the Contractor shall prepare general arrangement/markings drawings, fabrication drawings, erection drawings, bill of materials, shipping documents and nut and bolt lists. Bill of materials shall form part of fabrication drawings and shall be included in the body of the drawing or prepared separately. Two copies of drawings and documents shall be submitted to the Purchaser for their scrutiny and approval. One set of the Fabrication drawings will be returned to the Contractor with a stamp signifying "Approved", "Approved as noted" or "Not Approved" on the drawing. After the final approval by the Purchaser the Contractor shall furnish to the Purchaser within 2 weeks....copies of the approved Fabrication drawings, and erection drawings.
- 07.04.03 Despite approval of purchaser, Contractor shall not be relieved of his responsibilities for the accuracy of the detailed dimensions shown thereon and the safety of all structural connections as per forces indicated in the design drawings.
- 07.04.04 Soon after the fabrication of steel work pertaining to a particular drawing is completed, immediate steps shall be taken by Contractor to incorporate in the approved fabrication drawings, all the authorised corrections, additions and alterations made during the course of fabrications and 2 sets of the same shall be submitted to purchaser for his record.
- 07.04.05 Notes on specifications shown on design drawings shall be considered as superseding or overriding the specifications given elsewhere, with which they conflict. On all drawings, dimensions shown in figures shall be acted upon.
- 07.04.06 Two sets of erection drawings shall be submitted to the Purchaser showing thereon all authorised additions and alterations during the process of erection. These drawings together with drg under clause 37.4 shall be treated as "As Built" drawings.

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07.04.07 Supply and distribution of fabrication drawings and other documents like bolt list, etc. for the Contractor's own use or for the use of his Sub- contractors shall be the responsibility of the Contractor.

07.05 MATERIAL

07.05.01 The Contractor shall arrange and procure all steel sections, plates, GCS sheets, AC Sheets, glazings, flashings, fixtures and fittings required for sheeting and glazing, aluminium or MS astragals and frames for glazing , clips, all the consumables like bolts, turned and fitted bolts, nuts including spares and service bolts, washers of different types, electrodes, gas, shims, packs, paints, etc. for completing the work satisfactorily and the cost of the same shall be deemed to have been covered in his quoted price.

07.05.02 If assistance is required by the Contractor in obtaining permits/proprieties in allotment of controlled/scarce materials, if any, the same may be extended by the Purchaser by way of issue of recommendation letter, essentiality it certificate etc. to Government Authorities. Delay, if any, in obtaining the materials will not constitute a ground for claiming any compensation or extension of time.

07.05.03 Where any raw materials required for the execution of the contract is procured with the assistance of the Purchaser or permit /licence /quota certificate or release order issued by or on behalf of or under authority of Purchaser or by any officer empowered on their behalf by law, or where advance payments are made to the Contractor to enable him to purchase such raw material for execution of work, the Contractor:-

- a) Shall hold such materials as trustee for the Purchaser.
- b) Shall use such materials economically and solely for the purpose of the contract.
- c) Shall not dispose of the same without prior permission in writing from the Purchaser.
- d) Shall maintain and produce due documents indicating stock position / consumption of such materials from time to time, as required by purchaser.

07.05.04 The Owner may plan to procure and supply from the producers/stockyards major items of structural steel such as RS Joists, channels, angles, plates etc., required for the work. In that case these will be supplied to the Contractor in the indented lengths or standard lengths available, as received from the suppliers.

07.05.05 As the steel is procured by the Contractor, test certificates for the same shall be made available to the Purchaser.

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07.06 CONTRACTOR'S RESPONSIBILITY

07.06.01 The Contractor shall at his own cost properly store all materials brought by him to the work site/ Fabrication shop to prevent damage due to rain, wind, direct exposure to sun etc. and also from theft pilferage etc.

07.07 EQUIPMENT

07.07.01 All construction and equipment once brought by the Contractor within the Project Area, are not to be removed from there without the written authority from the purchaser.

07.08 DESPATCH OF FABRICATED MATERIALS

07.08.01 The Contractor is solely responsible for any loss or damage during transit to any of the fabricated members, and as such proper precautions shall be taken by him to guard against such mishaps.

07.09 SETTING OUT

07.09.01 The Contractor shall be responsible for checking the alignment and levels of foundations, correctness of foundation, centres of anchor bolts etc. well in advance of starting erection work and shall be responsible for any consequence for non-compliance thereof. Discrepancies, if any, shall immediately be brought to the notice of the Purchaser. Any mistake subsequently found in alignment and levels of the structural steelwork due to non-verification of foundation before erection shall be corrected by the Contractor at his own expense.

07.09.02 One set of reference axes and one benchmark level will be furnished to the Contractor. These shall be used for setting out of structures. Maintenance of such benchmark level shall be the responsibility of the Contractor.

07.09.03 The Contractor at his own expenses shall provide measuring instruments for setting out, leveling and aligning steelwork.

07.10 STAGING

07.10.01 Any staging necessary for the pre-assembly work of structures shall be provided by the Contractor at his own expense.

07.11 RULES & REGULATIONS OF SAFETY, ELECTRICITY BOARDS, FACTORY ETC.

07.11.01 The Contractor shall at all times comply with all relevant factory acts, electricity rules, safety regulations etc. as per statutory regulations of Central / State Government.

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07.12 DEVIATIONS

07.12.01 Should the Contractor wish to deviate from any specification or details shown on the purchaser's approved drawings and / or Technical Specifications, he shall obtain the purchaser's written authority before proceeding with the deviations.

07.13 BASIS OF PAYMENT

07.13.01 The tenderer shall give the break-up prices as required in the Schedule of Items. As the quantities mentioned are estimated quantities, payment will be made on the actuals as per the agreed rates.

07.14 EXTRA ITEMS

07.14.01 Works which are not included in the schedule of items but which are required to be carried out for completion of the project, shall be carried out as per specifications, drawings, and /or sketches to be issued by the Purchaser. The payment for such items shall be based on rates to be derived wherever possible from available agreed rates. If such derivation of rates is not possible, the rates for such items shall be derived on the basis of actual cost of materials, labour and transportation, which shall be substantiated with relevant documents and records by the Contractor and verified by the Purchaser or his authorised representatives. An overall margin of 15 % towards cost of overhead and profit will be allowed.

07.15 MEASUREMENTS

07.15.01 STRUCTURAL STEEL

Structural steelwork will be measured by the metric tonne and as per IS:1200 (part-8)- 1993 and IS:1200 (part-9)-1973 subject to provisions outlined below:-

- a) The calculation of quantities shall be based on unit on weights for structural sections as given in IS:808-1989 . In the case of mild steel/SAIL-MA Steel plates, the calculated weights shall be based on 78.5 kg per square metre per centimetre thick plate. The payments will be made on the basis of weights of members given in the approved fabrication drawings. However, any changes on the above weights during fabrication erection, payment shall be based on sketches Approved by the purchaser.
- b) In the event the I.S. does not specify any mode of measurement for a particular item of work, the same shall be measured as per any other relevant international standard or as directed by the Purchaser.
- c) The weight of all plates and sections shall be calculated from the approved drawing using the minimum overall square or rectangular dimensions and theoretical weight, no deduction being made for skew cuts, holes etc. In the

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case of plates, other than gussets, the actual dimensions shown on approved drawings will apply unless approved otherwise by the purchaser based on cutting diagram of mother plates.

- d) The weight of all welding runs, bolt, stanchion base packing, cuttings to waste and rolling margins, and coatings of paint, will be excluded from the measured weight and shall be deemed to have been allowed for in the rates for structural steelworks quoted by the Contractor.
- e) Temporary works and all other materials not included in the permanent works shall be excluded from any measurement for payment.

07.15.02 CLADDING SHEETS

- a) Sheeting for roof slopes, louvres of big size and side cladding shall be measured by the square metre of net laid area, as specified and shown on the drawings.
- b) No allowance shall be made for wastage, cut-outs, overlaps etc. in the measurement.
- c) The unit of measurement as specified in clause 47.2.1 shall include all fasteners, flashings and fittings such as ridges, corners, aprons and other accessories.
- d) No deductions shall be made for openings for area less than a single sheet. Also no extra payment will be made for making opening and installing ventilation chimneys on roof.

07.16 PRELIMINARY ACCEPTANCE

- 07.16.01 After completing the erection of a unit or portion thereof, the Contractor shall give a notice in writing stating that the job is complete in all respects and ready for preliminary acceptance. The job shall be jointly inspected visually by representatives of Contractor and Purchaser. All observed defects and omissions as per drawing and specification shall be noted down. If the defects are not major in the opinion of the purchaser/Purchaser's representative, the Contractor will be issued a preliminary acceptance certificate mentioning the defects, deficiencies and omissions which shall be made good by the Contractor within a period of 4 weeks.

07.17 FINAL ACCEPTANCE

- 07.17.01 Before commencement of inspection for final acceptance of the building or unit, the Contractor shall make available two complete sets of all drawings, representing "AS BUILT" drawing, (i.e. all additions and alterations done during fabrication and erection shall be incorporated in the drgs, Refer clause 35.4 & 35.6).
- 07.17.02 The Contractor shall make good all defects deficiencies and omissions noted down

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during preliminary acceptance (Refer clause 48.1) and shall inform in advance the Purchaser/ his representative for conducting inspection for final acceptance. Final acceptance certificate will be issued by the Purchaser / his representative only after all defects / deficiencies / omissions noted under Preliminary Acceptance have been rectified .

07.18 MAINTENANCE & GUARANTEE

07.18.01 Commencing from the date of issue of final acceptance certificate or conclusion of Final acceptance tests, the Contractor shall stand guarantee for a period of 12 calendar months, for the satisfactory performance of steel structures of the unit. In the event of issue of more than one certificate by the Purchaser, maintenance period shall commence from the date of issue of last certificate for the particular unit. The Contractor shall replace/rectify all parts/ components, which become defective due to poor quality of material, bad fabrication or erection or due to any act of oversight or omission. Any leakage noticed in roof or side sheeting during this period shall be rectified or affected sheets shall be replaced. All such rectification or replacements of defective materials or workmanship shall be done free of cost by the Contractor.

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ANNEXURE – A : MATERIAL OF CONSTRUCTION (AS APPLICABLE)

1. Material shall generally be as follows unless otherwise specified in drawings.
 - a) All rolled sections and plates upto 20 mm shall conform to Grade-A of IS:2062-1992 and shall generally be of tested quality.
 - b) Plates above 20mm thk and plates of structures subjected to dynamic loading shall conform to Grade-B of IS:2062-1992.
 - c) High strength micro-alloyed steel shall conform to IS:8500 and should be equivalent to SAIL-MA 350 HYA/HYB (SAIL product).
2. Steel sheets shall conform to IS:1079-1988.
3. Chequered plates shall conform to IS:3502.
4. All gratings shall be pressure locked electroforged.
5. Steel tubes for structural purposes shall conform to IS:1161-1979 (Grade YST-240).
6. Crane rails shall conform to IS:3443-1980.
7. Collectors and downcomers shall be ERW410 pipes conforming to IS: 3589 – 2001.
8. GCS sheets shall conform to IS 277:1992. Material shall be of designation GC (Grade “O” of IS1079 : 1994). Grade of zinc coating shall be 275 (total of both sides 275 gm/sq. m) and profile shall be Grade A (depth and pitch of corrugation 17.5 and 75 respectively) in accordance with the above code. 1 mm thick sheet shall be used for roof and 0.8 mm thick sheet shall be used for side sheeting.
9. Asbestos cement sheets shall be of 6 mm thick conforming to IS:459-1992.
10. Aluminium Industrial Troughed sheets conforming to IS:1254-1990 shall be used. 0.9 mm thick sheet shall be used for roof and 0.71 mm thick sheet shall be used for side sheeting.
11. Translucent sheets shall be of 1.2 thk fiberglass/ ploycarbonate with light blue tinge and shall conform to IS: 12866 –1989. The profile of translucent sheet shall match with that of GCS/ ACC sheets as applicable.
12. Permanent colour coated sheets shall conform to Class 3 of IS 14246 : 1995 or equivalent duly approved by the client and profile shall be in accordance with that of GCS/ ACC sheets as applicable.
13. Glazing shall be 6 mm thick rough cast wired glass as per IS: 3548-1988.
14. Mineral wool for insulation shall conform to IS : 8183 - 1993.
15. All permanent bolts shall be of Grade B (semi precision) conforming to IS: 1364(Part 2) – 1991. The materials of bolts shall be of Class 4.6 and conforming to IS: 1367 – 1991 unless noted otherwise. Hexagonal nuts for permanent bolts shall conform to IS: 1364(Part 3) – 1983.
16. All erection bolts shall be black hexagonal bolt of Grade C conforming to IS: 1363(Part 1) – 1984. The materials of bolts shall be of Class 4.6 and conforming to IS: 1367 – 1991 unless noted otherwise. Hexagonal nuts for erection bolts shall conform to IS: 1363(Part 3) – 1984.
17. All washers shall conform to IS:1148-1982.
18. All HSFG bolts shall conform to IS:3757-1985 with high strength structural nuts shall conform to IS:6623:1985 and hardened steel washers to IS: 6649:1985.
19. Stainless steel/ SAILHARD liner plates shall be as specified in drawings.
20. Covered electrodes for arc welding shall conform to IS:814- 1991. Electrode to be used for submerged arc welding shall conform to specification IS:7280-1974. Coding of electrodes shall be as follows.
 - a) ER 421 'C' x for mild steel of Grade A and Grade-B as per IS:2062-1992.

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b) EB 542 'C' x H3X for

- Mild Steel of Grade B as per IS:2062-1992 for dynamically loaded structures (arising out of crane, vibratory screen, equipment etc.).
- For SAIL-MA micro alloyed steel 350 HYA/HYB.
- When combined thickness (CT) for steel conforming to IS:2062-1992 exceeds 40mm as per Fig.1 below.

where "C" is the value of current as recommended by the electrode manufacturer.

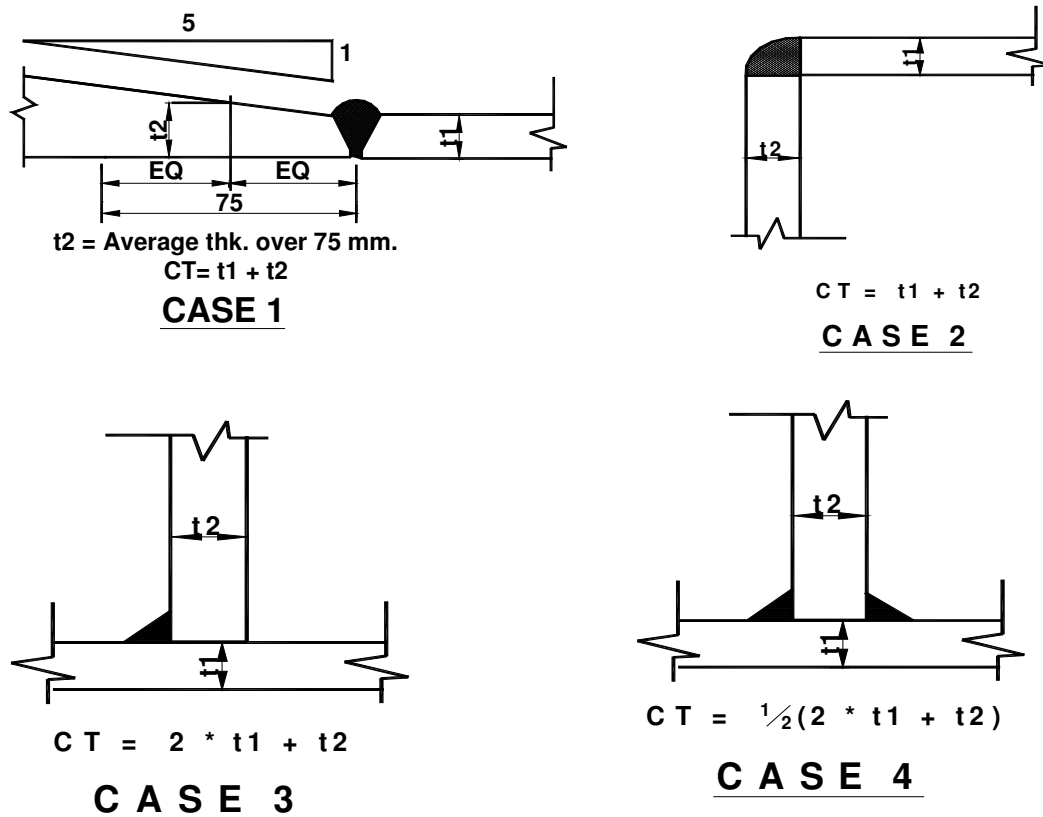


Fig. 1 – For Calculation of Combined Thickness(CT)

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**ANNEXURE - B : PERMISSIBLE DEVIATIONS IN PITCH AND GAUGE OF HOLES FOR BOLTS
AND RIVETS OF NORMAL ACCURACY (HIGH STRENGTH BOLTS INCLUDED)**


Description	Hole diameter (mm)	Permissible deviations in spacing (mm)	Permissible deviations in each group of holes		
			Mild Steel	Low Alloyed Steel	
				Rivets	Bolts
Deviation in the hole diameter	Upto 17 Above 17	+1 +1.5	No limits		
Ovality (difference between the biggest and the smallest dia)	Upto 17 Above 17	+1 +1.5	No limits		
Curves, exceeding 1 mm and cracks on the hole edges			Not Permissible		
Non-coincidence of holes in separate details of the assembled unit, • upto 1mm • 1-1.5 mm			Upto 50% Upto 10%	Upto 10% Not Perm.	Upto 50% Upto 10%
Slope of axis		*	No limits	Upto 20%	No limits

* Upto 3% of the thk. Of unit but not exceeding 2mm in case of automatic and 3mm in case of manual pneumatic riveting. Anything exceeding the above mentioned figures is not permissible.

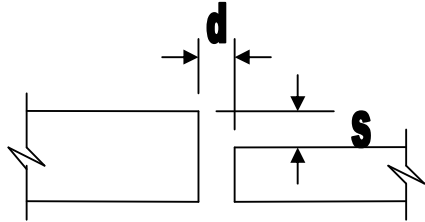
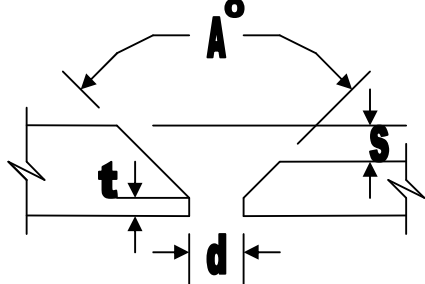
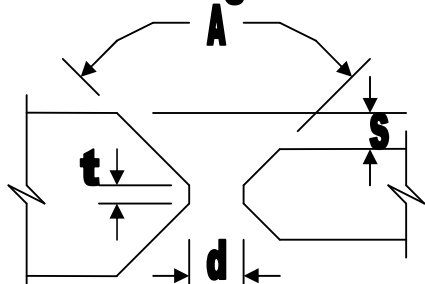
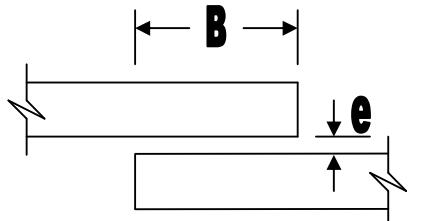
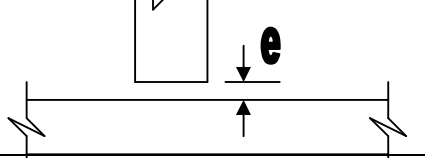
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ANNEXURE –C : TOLERANCE OF ASSEMBLED COMPONENTS OF STRUCTURES

Description of Components of Structures	Deviation(±) in mm for the Elements of Structures (Length in Metres)						
	<1	1-5	5-10	10-15	15-20	20-25	>25
Deviations from the dimensions assembled.							
Length & width of the Details Cut :							
• Manual gas Cutting as per marking	3	3.5	4	4.5	5	-	-
• With shears or with a saw as per marking	2	2.5	3	3.5	4	-	-
• With shears or saw with a stop	1.5	2	2.5	3	3.5	-	-
• Machine Gas Cutting	2	2.5	3	3.5	4	-	-
Length and width of planed ends processed on Edge Planing Machine	1	1.5	2	2.5	3	-	-
Distance between the Centres of the End holes							
• Drilled according to marking	2	2.5	3	3.5	4	-	-
• Drilled according to a gauge with bushing	1	1.5	2	2.5	3	-	-
Distance between the centres of Adjacent holes							
• Drilled according to marking	1.5	-	-	-	-	-	-
• Drilled according to a gauge with bushing	0.5	-	-	-	-	-	-
Deviation in the dimensions of despatch elements after completion of fabrication, Assembled in positioners or in other devices with clamps in fixed positioners and also							
• According to guide blocks with pins	2	3	5	7	8	9	10
• Assembled with bolts	3	5	8	11	12	14	15
• Size (length & width) between Milled surface (for all cases of assembly)	1	1.5	2	2.5	3	3.5	4
• The same made in separate details during machining & fixed during the assembling work with clamps	2	3	5	7	8	9	10
• The same drilled according to positioners in finished structures	1	1.5	2	2.5	3	3.5	4

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ANNEXURE –D : EXTENT OF PERMISSIBLE DEVIATIONS IN ASSEMBLY OF WELDED JOINTS

	Description	Permissible Deviation	Diagram
1	Square Butt Joints <ul style="list-style-type: none"> Gap between the ends of plates (d) Stepping of one plate over the other (s) 	± 1 mm 1.0 mm	
2	Single V-groove Joints <ul style="list-style-type: none"> Bevel angle (A) Gap betn. Two (d) Stepping of one plate over the other (s) Root thickness (t) 	$\pm 5^\circ$ ± 1.00 mm 2.00 mm 1.00 mm	
3	Double V-groove Joints <ul style="list-style-type: none"> Bevel angle (A) Gap betn. Two (d) Stepping of one plate over the other (s) Root thickness (t) 	$\pm 5^\circ$ ± 1.00 mm 2.00 mm 1.00 mm	
4	Lap Joints <ul style="list-style-type: none"> Overlap (B) Gap between the surfaces (e) 	5.00 mm 1.00 mm	
5	Tee Fillet Joints <ul style="list-style-type: none"> Gap between the edge of the web and the surface of the flange (e) 	2.00 mm	

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ANNEXURE – E : TOLERANCES IN ERECTED STEEL STRUCTURES

A. COLUMNS

S.N	Description	Tolerance (mm)
1.	Deviation of column axes at foundation top level with respect to true axes in Longitudinal / Lateral direction.	± 5
2.	Deviation in the level of bearing surface of columns at foundation top with respect to true level	± 5
3.	Out of plumbness (vert.) of column axis from true vertical axis and measured at column top : a) For columns without any special requirements : • Upto and including 30m • Over 30 m height b) For column with special requirements like cranes or such similar requirements : • Upto and including 30m • Over 30 m height	± H/1000 subjected to ± 25mm maximum ± H/1200 subjected to ± 35mm maximum ± H/1000 subjected to ± 20mm maximum ± H/1200 subjected to ± 35mm maximum
4.	Deviation in straightness in longitudinal & transverse planes of columns, at any point along the height.	± H/1000 subjected to ± 10mm maximum
5.	Difference in the erected position of adjacent pairs of columns along length or across width of building, prior to connecting trusses / beams, with respect to true distance.	± 5
6.	Deviation in any bearing or seating level with respect to true level.	± 5
7.	Difference in bearing levels of a member on adjacent pair of columns both across and along the building, from the true difference.	
NOTES: Tolerance specified under 3(a) and 3(b) should be read in conjunction with 4 and 5. "H" above is the column height in mm.		

B. TRUSSES

S.N	Description	Tolerance (mm)
1.	Shift, at the centre of top chord member of truss with respect to the centre of span or vertical plane passing through the centre of bottom chord.	± 1/250 of height of truss in mm at centre of span subjected to ± 15mm maximum.
2.	Lateral shift of top chord of truss at the centre of span from the vertical plane passing through the centre of supports of the truss	± 1/1500 of span of truss in mm subjected to ± 10mm maximum.
3.	Lateral shift in location of truss from its true vertical position.	± 10
4.	Lateral shift in location of purlins from true position	± 5
5.	Deviation in difference of bearing levels of trusses or beam from the true difference.	± L/1200 subjected to ± 20mm maximum. (where L=span)

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C. CRANE GIRDERS & RAILS

S.N	Description	Tolerance (mm)
1.	Shift in the centre line of crane rail with respect to centre line of web of crane girder.	$\pm (\text{web thickness in mm} + 2) / 2$
2.	Shift in plan of alignment of crane rail with respect to true axis of crane rail at any point.	± 5
3.	Deviation in crane track gauge with respect to true gauge <ul style="list-style-type: none"> • For track gauge upto and including 15 m. • For track gauge more than 15 m. 	± 5 $\pm (5+0.25(S-15))$, subject to maximum of +10 mm, where S in metres is the true track gauge
4.	Deviation in the crane rail level at any point from true level	± 10
5.	Difference in levels between crane track rails (across the bay) at <ul style="list-style-type: none"> • Supports of crane girders • Mid span of crane girders 	15 20
6.	Relative shift of crane rail surfaces at a joint in plan and elevation	2 mm subject to grinding of surfaces both for smooth transition
7.	Relative shift in the location of crane stops (end buffers) along the crane tracks, along track gauge.	1/1000 of track gauge S in mm subject to maximum of 20 mm

D. CHIMNEY & TOWERS

S.N	Description	Tolerance (mm)
1.	Out of plumbness vertically from the true vertical axis	1/1000 of the height

E. BUNKERS

S.N	Description	Tolerance (mm)
1.	Deviation in length of bunker from true length	$\pm 1/1000$ of length
2.	Deviation in width of bunker from true width	$\pm 1/1000$ of width
3.	Deviation in height of bunker from true height	$\pm 1/1000$ of height

NOTES :-

1. The tolerances specified do not apply to steel structures where deviations from true positions are intimately linked with or directly influence the technological process. In such cases, the tolerances on erected steel structures shall be as per recommendations of process technologists / equipment suppliers.
2. The observed or calculated values of deviations of steel structures from their true positions shall be rounded off in accordance with IS:2-1960 for comparison with permissible tolerances specified in this table. The number of significant places retained in the rounded-off value should be same as that specified in this table.

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ANNEXURE – F : SCHEDULE OF QUANTITIES

Sl.no	Description	Unit	Quantity	Rate	Amount
1	Preparation and supply of fabrication drawings, material indents, bolt lists, Bill of materials, fabrication of structures including supply of raw materials. loading, transportation and delivery at site with one coat of primer paint applied at shop as described under 01.03 inclusive of supply of bolts, nuts , washers, electrodes,jigs, fixtures and other consumables including all tools ,tackles & labour and all works as per specifications and drawings.	t	60		
2	Erection of steel structures including receiving of fabricated structures at site, storing and handling, site assembly inclusive of supply of bolts,nuts,washers,electrodes, jigs, fixtures and other consumables including all tools , tackles & labour , application of primer paint after erection as specified in the drawing, followed by application of finishing paints, all works complete as per specifications and drawings.	t	60		
3	Preparation of sheeting drawings, procurement of GCS sheets(1mm thick) flashing of plain GI Sheets, corners ridges, galvanised fittings and fixtures, transportation to site, cutting and bending of sheets to required shapes and size and erecting them in roof & side at proper position, all work as per specifications and drawings (net laid area to be measured).	Sq.m	1350		
3	Preparation of sheeting drawings, procurement of translucent sheets made of 2 mm thick fibre glass reinforced polyester(FRP) sheets,of matching profile with GCS sheets with appropriate , fittings and fixtures, transportation to site, cutting and bending of sheets to required shapes and size and erecting them in roof & side at proper position, all work as per specifications and drawings (net laid area to be measured)	Sq.m	150		
4					

NOTES

1. The Bidder shall quote rates against items of "nil" quantities also.
2. The quantities indicated are estimated values and hence are approximate. Final payment will be made based on actual quantities to be certified by the Purchaser.

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3. The cost of MS bolts (permanent and service), washers, electrodes, putty, gases, cost of straightening the raw materials, cutting of flats from plates and providing splices, paints, tools, plants, etc., as required for the work shall be deemed to be included in the quoted rates.

4. All handling and transport charges of raw materials and fabricated structures including double handling as required for completion of work in accordance with time schedule, are deemed to be included in the quoted rates.