Project: Seed processing Unit at Sherghati, Gaya/ Kudra, Kaimur

Specifications for PEB Structure

PRE ENGINEERED STEEL BUILDING STRUCTURE (PEB STRUCTURE)

Structural Members

Curved Rafter: Primary (Build-up) sections for CURVED RAFTER shall be fabricated from hot rolled steel plates conforming to ASTM A 572M Grade 50 **or equivalent with minimum yield strength of 345 MPa**. FlanENG I/Cs shall be welded to the web by a continuous double side fillet weld (min. 8mm) deposited by an automatic submerENG I/Cd arc welding process. The Built up frame shall be shot blast & primed with one coat of zinc rich/Epoxy primer paint applied and two coats of paint as specified.

Purlins, Runner & Bracings : Secondary members viz. Purlins and Runners shall be · Square Hollow Sections: as per IS : 4923 and Rectangular Hollow Sections as per IS : 4923, manufactured by the HFIW (High Frequency Induction Welding) process, from **high quality Hot Rolled coils of YST 310 grade sections**. The bracings will of grade of steel as specified in the drawings.

Galvalume Roofing Sheet- Coloured

Galvalume sheet shall be 0.60mm thick (total coated thickness), 550 MPa minimum, yield strength. It shall be coated with hot deep alloy of 55% Aluminum 43.5%.Zinc 1.5% Silicon and finished with resin coat on both surfaces @ 150gm/sqm of coating(total both surfaces) having overall width and laid width and as specified and shall be fixed using hot dip galvanized, self drilling and self tapping screws neoprene and EPDM washers. Penetration and laps in sheet shall be sealed by using proper bead mastic. HDPE fillers shall be provided wherever required to close voids between sheets, sheet & fasteners etc.

Fixing system shall be as per manufacturers instructions and shall be safe against effects of Wind velocity. End Lapping will be minimum 200mm.

Wall Panels – Coloured

Panels shall be roll formed from nominal 0.60mm base metal thickness of minimum yield strength of 550 MPa, coated with an aluminum / zinc alloy (i.e. Zincalume Steel), (min 150 gm/m² total on both sides), conforming to Australian standard AS1397, pre-painted with Colorbond steel quality paint. The paint finish thickness shall have a total coating thickness of nominal 35µm, comprising of nominal 20µ m on exterior face and nominal 5µ m reverse coat on interior face over nominal 5µ m epoxy primer coat on both surfaces of approve color shade by ENG I/C. The steel manufacturers face certificate for the chemical and mechanical properties of steel shall be submitted for approved by the ENG I/C prior to installation. The sheet shall have brand marking of the manufacturer giving products details on the back of the sheet.

Profile dimensions

Roof and Wall Trapezoidal type profile sheet shall have 1000- 1015mm effective cover with, nominal 28mm deep ribs with subtle square fluting in the five spans at nominal 203mm centre to centre. The wide valley shall have a sloping profile for faster rainwater run off and as per detailed Drawing. The end rib shall be designed anti-capillary action, to avoid any seepage of water through the lateral overlap. The profile and colour of the Sheet shall be sample approved by the ENG I/C.

Trims & Gutters

Wall flashing and trims (gable, corner, framed opening, accessories, etc.) shall be manufactured from s ame color, finish and thickness as wall panels. Roof flashing and trims (parapet flashing, transition

trims, expansion join trims and ridge caps) shall be manufactured from same color, finish and thickness as roof panels. Eave gutters and downspouts shall be cold formed from same material wall panels and as per approved Brand List.

Protection Accessories
Protection net shall be provided as per manufacturer's recommendation.

Accessories
Anchor bolts shall be manufactured from rods conforming to ASTM A 36M Grade 36 or equivalent with minimum yield strength of 240 MPa and an ultimate strength of 400 MPa.

Bracing rods, used in sidewalls of buildings supporting cranes shall be solid plain round steel bars conforming ASTM A 36M or equivalent with minimum yield strength of 240MPa.

FlanENG I/C braces used to stabilize the inner flanges of main frame columns and rafters shall be 50mm x 50mm x4mm steel angles conforming to ASTM A 36M (or equivalent) with minimum yield strength of 240 MPa.

Panel Endlap: The panel lap shall be minimum 200 mm and sealed with bead mastic or Rope seal tape.

Sealant: Special grade of silicon non-hardening, neutral cure type of approved make and grade shall be applied at all side laps and endlaps (with flowable mastick) as per manufacturer's recommendation and approval by ENG I/C.

Bead mastic shall be an extruded elastomeric butyl rubber based sealant supplied in rolls on silicon release paper conforming to Federal Specification TT-C-1796 A Type II Class B (or equivalent).

Flowable mastic (caulking sealant) shall be a neutral cure silicon rubber sealant that is chemically insert and non corrosive, UV resistant and suitable for exterior applications against weathering and rainwater. When cured it is non-toxic and shall be able to accommodate high thermal and shrinkage changes in structural movement joints.

Foam closures shall match the panel profile. They shall be made of expanded polyurethane or similar material.

Fasteners/Screws: The fasteners for sheets will be SDTC (Self Driving Trapping Screws) with EPDM

Erection and Fixing:
The erection and fixing has to be done through approved steel Builder of Manufacturer of PEB structure as per Approved List (Append A)

The contractor shall be required to submit design calculation in support of proposed profile of the sheet and standard loading etc. to the satisfaction of Accepting officer. The contractor shall also submit methodology for fixing and also a maintenance manual for routine maintenance.

Special flashing, ridge capping and trims shall be fixed as per manufacturer's recommendation. The shape and girths shall be as per design requirement and shall be as approved by the ENG I/C.
Panel clips shall be positioned by matching the hole in the clip with the factory-punched holes in the secondary structural members.

Panel endlap, when required, shall be at least 200 mm sealed with neutral-cure sealant and fastened together clamping plates. Sealant shall contain hard nylon beads which prevent it from flowing

out due to clamping actions. The panel shall be joined by means of two-piece clamped connection consisting of a bottom reinforcing plate and at top panel strap. The panel endlap shall be located directly over, but not fastened to, a supporting secondary roof structural member and uniformly placed
The contractor shall ensure that panel erector is familiarized with the erection procedure and all the supporting members are straight, level and true (according to AISC) before starting panel erection. Panels shall be erected according to approved shop drawings.

QUALITY ASSURANCE PLAN AND QUALITY CONTROL MEASURES FOR PEB STRCTURES ARE GIVEN SEPERATELY IN APPENDIX –B.

Embossed Polycarbonate Translucent sheeting for Skylight

The panel shall be nominal 2.00 mm thick, embossed polycarbonate sheets of GE Lexan Make or equivalent. The profile should match that of the roofing sheets for fixing the translucent sheeting. The profile and properties shall be approved by ENG I/C before installation.

PEB REDESIGN ASPECTS & PARAMETERS

The contractor shall follow the design of the Pre Engineered Building (PEB) enclosed as approved as part of this tender. The Design and drawings are firm and will not be changed during construction / erection without prior approval of the ENG I/C.

Deviation in PEB Design by Contractor

In case of any deviation sought by the contractor in the PEB Structure , the Contractor shall take prior approval of the ENG I/C

2

APPENDIX – B

QUALITY ASSURANCE & QUALITY CONTROL
PEB Structure

Introduction

This specification shall be read in conjunction with other documents forming the contract viz. NIT, Instructions to Bidders, general conditions of contract, special conditions of contract, specifications of related works and other documents furnished by CLIENT.

The contractor shall visit the site and ascertain the local conditions, entry and traffic restriction, all obstructions in the area and also ascertain all site conditions. The contractor shall allow for extras likely to be incurred due to such conditions and no claim shall be entertained on this account under any circumstances from the contractor.

The contractor shall set out and level the works and will be responsible for the accuracy of the same. The contractor is to provide all instruments and proper qualified staff with labour for getting his work checked by ENG I/C.

The contractor shall take adequate precautions to ensure complete safety and prevention of accidents at site. The safety precautions shall conform to the relevant IS codes, laws and local regulations.

The contractor shall protect surveyor's bench marks and reference lines, ground water gauges and control points from damage or movement during work. In case of any damage, the contractor shall have to restore to original condition at his own cost.

Standards & Site Condition

The design and installation shall fully comply with the requirements of the Bureau of Indian Standards and other statutory regulations that are in force in the place of installation. The work shall be carried out in accordance with the latest editions of relevant BIS Standards particularly the following and wherever Indian Standards are not available, international standards shall be followed:

a. IS 875: 1987 Code of practice for design loads (other than earthquake) for buildings and structure.
   i. (Part I) Dead Loads – Unit weights of building materials and stored materials
   ii. (Part II) Imposed Loads
   iii. (Part III) Wind loads
b. IS 800: 2007 Code of Practice for general construction in steel
c. IS 1893: Part I: 2002 Criteria for earthquake resistant design of structures – general provisions and buildings
d. IS 1893: Part 4: 2005 Criteria for earthquake resistant design of structures – Industrial Structures including stack-like structures
e. IS: 513: 1994 Cold-rolled low carbon steel sheets and strips
f. ARE 814: 1991 Covered electrodes for manual metal arc welding of carbon and carbon manganese steel
g. IS 733:1983 Specification for Wrought aluminum and aluminum alloy Bars, Rods and Sections (for General Engineering Purposes)
h. IS 1081:1960 Code for Practice for Fixing and Glazing of Metal (Steel and Aluminum) doors, windows and ventilators.
j. IS 1868:1996 Anodic coatings on Aluminum and its Alloys-specifications
k. IS 1948 :1961 Specification for Aluminum Doors Windows and Ventilators
l. IS 5523 :1983 Methods of Testing Anodic Coatings on Aluminum and its alloys

Site Conditions

Mean annual rainfall 171.8 cm
Basic wind speed 180 km per hour (as per IS 875- Part 3)
Seismic Zone – Zone V as per IS: 1893
Maximum ambient temperature 35 deg C
Minimum ambient temperature 5 deg C

3

QUALITY ASSURANCE

In addition to the special provisions made hereafter as to the sampling and testing of materials by particular methods, samples of materials and workmanship proposed to be employed in the execution of the work may be called for at any time by ENG I/C and when so called for by the Client, the same shall be furnished by the contractor free of cost without delay. The samples when approved shall be kept by

CLIENT who shall reject all materials or workmanship not in conformity with the quality and character of the approved samples. Suitable labelled boxes for the storage of the said samples shall be provided by the contractor free of cost.

The contractor shall furnish to the ENG I/C the following certificates/documents before commencement of fabrication work at any time thereafter as described by the ENG I/C:

A certificate stating the process of manufacture, physical properties and chemical composition of the steel supplied.

Test certificates by the manufacturer giving the results of each of the specified mechanical tests applied to the structural steel, bolts, nuts and rivets and the chemical composition of the same.

QUALITY ASSURANCE PROGRAM (QAP)

All the structural materials shall be inspected by the CLIENT / ENG I/C or its appointed 3rd party inspector before dispatch to site for installation. Should any structure be found not to comply with any of the provisions of this specification, it shall be liable for rejection. No structure or part of the structure, once rejected shall be re-submitted for inspection / test, except in cases where the ENG I/C considers the defect as rectifiable.

DRAWINGS

Unless otherwise stated, the contractor shall be responsible for the preparation of the shop detail (working) drawings, erection and marking plans and all necessary lists such as indents, and bolt lists, material lists and lists for all bought out items on the basis of design drawings.

All drawings prepared by the contractor shall be made to Indian standard size A1 according to IS: 696 – code of practice for general engineering drawings – unless otherwise approved by the ENG I/C. The drawings shall be fully referenced to relevant design drawings, marking/erection drawings and all interconnected drawings. All dimensions and other units shall be given in SI system.

FABRICATION STANDARD

All fabrication of structural steel work shall be in accordance with IS: 800 and as per the approved drawings unless otherwise specified. The fabrication shall be carried out in a state of the art manufacturing facility for pre fabricated structures with minimum following machines:

a. Automatic beam welding line
b. Plate shearing line
c. Radial drilling machines
d. Cold forming line
e. Hydraulic press
f. Shot blasting machines

The tolerances of fabrication of steel structures shall be in accordance with IS: 7215 unless otherwise specified.

TYPE OF CONSTRUCTION

The PEB steel structures shall generally be of shop welded construction.

STORING MATERIALS

All materials shall be stored properly on skids, above the ground. It shall be kept clean and properly drained. Structural steel members shall be so stored and handled that members are not subjected to excessive stresses and damage.

4

WORKMANSHIP

All workmanship shall be equal to the best practice in modern structural shops. Greatest accuracy shall be observed in the manufacture of every part of the work and all similar parts shall be strictly interchangeable.

All materials shall be straight and if necessary before work shall be straightened and/or flattened by pressure unless required to be of curvilinear form and shall be free from twists.

The erection clearance for cleated ends of members connecting steel to steel should not be greater than 2mm at each end. The erection clearance at ends of beams without web cleats should not be more than 3mm at each ends, but where for practical reasons a greater clearance is necessary, suitably designed seating or connections shall be provided.

Chipping of angles, flanges and edges of plates wherever necessary shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

The edges and ends of all flange plates and web plates of plate girders and built-up columns, of plates forming chords or web members of lattice girders, and all cover plates, the ends of all angles, tees, channels and other sections forming the flanges of plate girders and columns, and chords and web members of lattice girders shall be planed. Edge preparation for welding may be done by machine controlled flame cutting with edges free of burrs, clean and straight.

The top ends of all intermediate stiffeners shall be planed or ground to fit tightly to the main angles or flanges. Care shall be taken to ensure a full bearing of the stiffeners at the supports and at other points where concentrated load is applied. The ends shall not be drawn or caulked.
The butting surfaces at all joints of girders or columns shall be planed so as to butt in close contract throughout the finished joint.

Holes for bolts shall be drilled to conform to clause 10 of ARE: 7215. All holes, except as stated hereunder, shall be drilled to the required size or sub-punched 3mm less in diameter and reamed thereafter to the required size. Thickness of the material for sub-punching shall not be greater than 16mm. All matching holes for bolts shall register with each other so that a gauge of 0.8mm less in diameter than the hole can pass freely through the members assembled for bolting in the direction at right angle to such

members. All holes for turned and fitted bolts shall be drilled undersize of 1mm and after assembly, reamed to a tolerance of +0.13mm to 0mm unless otherwise specified. The parts shall be firmly bolted together during such block drilling and taken apart for removal of burrs after drilling.

Holes in purlins, side sheeting runners, packing plates and lacing bars may be punched full size, provided the thickness of the materials does not exceed 13mm. All punching and sub-punching shall be clean and accurate and all drilling shall be free from burrs. No holes shall be made by gas cutting process.

All parts assembled for bolting shall be in close contact over the whole surface and all bearing stiffeners shall bear tightly at both top and bottom without being drawn. The component part shall be so assembled that they are neither twisted nor otherwise damaged. Specified chamfers, if any, shall be provided.

Trial assemblies shall be carried out after fabrication to ensure accuracy of workmanship and those checks shall be witnessed by the CLIENT/ ENG I/C.

All turned and fitted bolts shall be carefully turned and shall be parallel throughout the barrel. The following limits of tolerance shall be permitted upon the diameter of the barrels of turned bolts and holes which they are to fit. Barrel of bolt hole Limit of tolerance High 0.00mm +0.13mm Low -0.13mm 0.00mm

The barrel of each turned bolt shall be of such a length that it is in full contact with the work throughout, the screwed portion being made at least 1.6mm less in diameter than the barrel or to suit the next smaller size of metric screw thread. The barrel portion shall be jointed to the thread portion by 45 deg chamfer within thickness of washer. Unless otherwise specified, faces of heads and nuts bearing of steel work shall be machined. All such bolts shall be provided with washers over a hole of 1.5mm larger in diameter than the barrel of bolt and thickness of not less than 6mm so that the nut, when tightened, shall not bear on the unthreaded body of the bolt. In all cases, where the full bearing area of the bolt is to be developed, the threaded portion of each bolt shall project through the nut by at least one thread. Tapered washers shall be provided for all heads and nuts bearing on beveled surface.

Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. This washer shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component (i.e. the bolt head or the nut) shall be 90+3 deg. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.

The nut shall be placed so that the identification mark is clearly visible after tightening. Nuts and bolts shall be always be tightened in a staggered pattern and, where there are more than four in any joint, they shall be tightened from the centre of the joint outwards.

At the time of assembly, the surface in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scales, burrs and other defects which would prevent solid seating of the parts or would interfere with the development of fabrication between them. It shall be the responsibility of the contractor to work with in the slip factor specified for the particular case.

If after final tightening a nut or bolt is slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again.

All the high tension bolts if used in construction are to be clearly marked on drawings with the appropriate torque tension required for fixing.

WELDING

The welding and welded work shall generally conform to IS: 816 and IS: 9595 unless otherwise specified. All welding work shall be carried out in shop and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses.

All electrodes shall be kept under dry conditions. Any electrode damaged by moisture shall not be used unless it is guaranteed by the manufacturer that when it is properly dried, there will be no detrimental effect. Any electrode which has part of its flux coating broken away or is otherwise damaged, shall be rejected. Any electrode older than six (6) months from the date of manufacture shall not be used.

The edges shall be prepared with an automatically controlled flame cutting torch correctly to the shape, size and dimensions of the groove, prescribed in the design and shop drawings. The welding surfaces shall be smooth, uniform and free from fins, tears, notches or any other defect which may adversely affect welding and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign matter.

The welding procedure shall be arranged by the contractor to suit the details of the joints as indicated in the drawings and the position at which welding has to be carried out. Welding procedures shall cover the following:

a. Type and size of electrodes
b. Current and (for automatic welding) arc voltage
c. Length of run per electrode, or (for automatic welding) speed of travel
d. Number and arrangement of runs in multi run welds
e. Position of welding
f. Preparation and set up of parts
g. Welding sequence
h. Pre or post heating
i. Any other relevant information

The welding procedure shall be so arranged that the distortion and shrinkage stresses are reduced to a minimum and that the welds meet the requirement of quality specified hereunder. Any weld found defective shall be cut by using either chipping hammer or gouging torch in such a manner that adjacent material is not injured in any way.

6

The contractor shall satisfy CLIENT/ Engineer-in-Charge that the welders are suitable for the work for which they will be employed and shall produce evidence to the effect that welders have satisfactorily completed appropriate tests as described in IS: 877. CLIENT may at his own discretion order periodic tests of the welders and/or of the welds produced by them. Such tests shall be at the expense of the contractor.

SHOP ASSEMBLY

The steel work shall be temporarily shop assembled as necessary so that accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

ERECTION MARKING

Each fabricated member whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site. These erection marks shall be suitably incorporated in the shop detail and erection drawings.

QUALITY CONTROL

To ensure good quality of workmanship the contractor shall control the fabrication and assembly of structures as per the procedure outlined below.

The contractor shall routine check execution of established technological processes or general technological instructions. All welds shall be visually examined and measured for external dimensions by appropriate gauges.

The contractor shall conduct tests in accordance with the following norms:

a. Visual examination – hundred percent (100%) of the welded joints.
b. Dye penetration test
c. Visual examination

The contractor shall conduct visual examination and measurement of the external dimensions of the weld for all joints. Before examining the welded joints, areas close to it on both side of weld for a width not less than 20mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of +0.1mm or by weld gauges. The contractor shall examine the following during the visual checks.

a. Correctness and shape of the welded joints
b. Incomplete penetration of weld metal
c. Influx
d. Burns
e. Un-welded craters
f. Under cuts
g. Cracks in welded spots and heat affected zones
h. Porosity in welds and spot welds
i. Compression in welded joints as a result of electrode impact while carrying out contract welding
j. Displacement of welded element

The contractor shall document all data as per sound laboratory practices.

Mechanical test

The contractor shall carry out various mechanical tests to determine weldability, nature of break, correct size and type of electrodes, degree of preheat and post-heat treatment etc. The type, scope and sample of various mechanical tests shall be determined in agreement with CLIENT/ ENG I/C. The number of tests conducted shall depend on the results obtained to satisfy CLIENT that the correct type and size of electrode, degree of preheating and post-heating and weldability of different metal are being followed.

Dye penetration test

The basic stages shall comprise surface preparation, application of penetrant, excess penetrant removal, developer application and inspection. The entire surface shall be subjected to dye-penetration test as per IS 3658 and the minimum acceptance standards shall be as outlined therein.

Inspection and Testing

The CLIENT/ ENG I/C shall have free access at all reasonable times to the contractor's works where the fabrication of steelwork is carried out and shall be afforded all reasonable facilities by the contractor for satisfying himself that the fabrication is being undertaken in accordance with the provisions of the drawings and specifications.

The contractor shall continuously inform the CLIENT/ ENG I/C of the progress in fabrication and as to when individual pieces will be ready for inspection. The contractor shall give a minimum of 15 working days notice to CLIENT/ ENG I/C for inspection of the individual pieces.

Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the CLIENT/ ENG I/C. All gauges and templates necessary to satisfy CLIENT shall be supplied by the contractor. CLIENT/ ENG I/C, may, at their discretion, check the test results obtained at the contractor's work by independent tests at the government test house or elsewhere and should the material so tested be found to be unsatisfactory, the costs of such tests shall be borne by the contractor.

Marking, Packing and Dispatching

Each piece shall be distinctly marked before delivery, in accordance with the approved marking diagram and shall bear such other marks as will facilitate erection. For easy identification at site a small distinguishing mark for each building shall be painted on each end of every member dispatched from fabrication shop. The fabricated steelwork shall be dispatched by the contractor in such portions as may be found convenient for erection or as ordered by CLIENT to meet the time schedule.

All projecting plates or bars and all ends of members at joints shall be stiffened, all straight bars and plates shall be bundled, all screwed ends and machined surfaces shall be suitably packed and all bolts, nuts, washers and small loose parts shall be packed separately in boxes so as to prevent damage or distortion during transit.

Storing and handling of materials

The fabricated materials on receipt at site shall be carefully unloaded, examined for defects, checked, stored out for each building and stacked securely on skids above level ground. The ground shall be kept clean and properly drained. Girders and beams shall be placed upright and stored. Long members, such as columns and chords, shall be supported on skids, placed near enough to prevent damage from deflection.

The fabricated material shall be verified with respect to markings on the marking plan or shipping lists supplied by the fabricator. Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be identified by painting in distinct colour. Such materials shall be dealt with as ordered by the CLIENT.

The handling and storing of the component parts of a structure shall involve the use of method and appliance not likely to produce damage by twisting, bending or otherwise deforming the metal. No member slightly bent or twisted shall be put in place until the defects are corrected and members seriously damaged in handling shall be rejected.

All small bends or twists received by members shall be rectified before such members are put in place, any serious bends or damage shall be reported at once to CLIENT by the contractor for instructions. The straightening of bent edges of plates, angles and other shapes shall be done by methods not likely to produce fracture or other injury. Following the completion of straightening of a bend or buckle, the surface of the metal shall be carefully inspected by the contractor for evidence of incipient or other fractures. The contractor shall immediately report to CLIENT presence of any such evidence and act according to his instructions.

Erection

Erection of structural steelwork shall be carried out in accordance with IS: 800 and in an expeditious manner in conformity with the drawings and specifications. The suitability and capacity of all plant, equipment etc used for erection shall be to the satisfaction of the CLIENT. The contractor shall provide all construction and transport equipment, tools, tackles, consumables, materials, labour, supervision for erection including carrying out the following:

Receiving, unloading, checking and moving into storage at site as outlined under general conditions including prompt attendance to all insurance matters as necessary for all materials arriving at site.

Transporting from site storage, handling, rigging, assembling, bolting, welding, and satisfactory installation of all fabricated materials in proper location according to drawings and or as directed by the CLIENT.

Checking centre lines, levels of all foundations blocks including checking lines, level, position and plumb of all bolts and pockets. The PEB contractor will co-ordinate with civil contractor for leveling, alignment, centering of foundation bolts & templates. The PEB contractor shall be responsible and shall fully satisfy himself regarding the correctness of the foundations before installing the fabricated structures on the foundation blocks.

Aligning, lining, leveling, bolting, securely fixing in position in accordance with drawings or as directed by the CLIENT/ENG I/C.

Painting as per specification including supply of paint. supply of all required consumables, construction and erection materials, including but not limited to gauges, welding, gases and rods, electrodes and wires, oxygen, acetylene, fuel, bolts, nuts, rivets, shims and temporary supports etc as required for incidental works and for the completion of erection.

Erection shall also include the following work:

All minor modification such as:

Removal of bends, kinks, twists etc for parts damaged in transport and handling.
Cutting, chipping, filing, grinding etc if required for preparation and finishing of site connections.
Reaming for use of next higher size of rivet or bolt for holes which do not register or which are damaged.
Welding of connections in place of riveting or bolting for which holes or either not drilled at all or wrongly drilled during fabrication. Welding in place of riveting or bolting will be permitted only at the discretion of the CLIENT/ ENG I/C.

The following shall be considered as a legitimate part of erection work:

Re-fabrication of parts damaged beyond repair during transport and handling or is incorrectly fabricated.
Fabrication of parts omitted during fabrication by error, or subsequently found necessary.
Plug welding and re-drilling of holes which do not register and which cannot be reamed for use of next size of rivet or bolt.
Drilling of holes which are either not drilled or drilled in incorrect positions during fabrication.

Setting out

The contractor shall be responsible for checking the alignment and levels of foundations, correctness of foundation bolt centres, their projected height above the foundation tops, and length of threading provided and the provision and fitment of nuts for the foundation bolts. These shall be checked well in advance of starting erection work and the contractor shall be responsible for any consequence for noncompliance thereof. Discrepancies, if any, shall immediately be brought to the notice of CLIENT for advice.

One set of reference axes and one bench mark level will be furnished to the contractor. These shall be used for setting out of structures.

The contractor shall assume full responsibility for the correct setting out of all steelwork and erecting it correctly as per alignment and levels shown on the drawings and plumbing of vertical members. Not withstanding any assistance rendered to the contractor by the CLIENT, if at any time during the progress of the work any error should appear or arise therein, on being required to do so, the contractor at his own cost shall remove and amend the work to the satisfaction of CLIENT.

Assembly and Erection

Before starting erection, the contractor shall submit to CLIENT for approval the method he proposes to follow and the number and the type of equipment and temporary work he proposes to use for the erection. The approval of the CLIENT/ENG I/C shall not be considered as relieving the contractor from his responsibility for the loads which the erection equipment and temporary work will be required to carry or support. Adequate allowance and provision shall be made for lateral forces and wind loads. Drawings for such temporary work shall be submitted to the CLIENT/ ENG I/C for prior approval, if so desired by him.

The contractor shall plumb and level all steelwork and shall thoroughly brace and guy the structures during erection to keep them plumb and rigid till completion. Erected parts of the structure shall be stable during all stages of erection and the structural elements to be erected shall be strong enough to bear erection loads. The stability of structures subject to the action of wind, dead weight and erection forces shall be obtained by observing specified sequence of erection of vertical & horizontal structural members

by installing permanent and temporary bracings. As the work progresses, the steel members shall be securely bolted up to take care of all dead loads, wind and erection stresses, including those due to erection equipment or its operation. No permanent bolting, welding or grouting shall be done until proper alignment has been obtained and approved by the CLIENT/ENG I/C.

The contractor shall provide adequate supervision at all stages of the work and examine each portion for accuracy before fabrication or erection is commenced. He shall also provide facilities such as, adequate temporary access ladders, gangways, tools and tackles, instruments etc to the satisfaction of the CLIENT/ ENG I/C, for his inspection at any stage during erection. Irrespective of any inspection and tests made by the CLIENT, contractor shall be entirely responsible for the proper execution of the work, not withstanding any approval, which may have been given by the CLIENT/ ENG I/C of the work or of tests carried out either by CLIENT or by the contractor.

Guarantee

The Contractor shall guarantee the performance of the structure in a form approved by CLIENT/ ENG I/C and shall indemnify CLIENT against any failure, partial or otherwise, arising out of any improper fabrication or erection for a minimum period of 25 years from the date of handing over of the buildings.

The contractor will submit a comprehensive maintenance manual for the PEB Structure to CLIENT as a part of final document submission.

Vacuum Dewatering Concrete : Provide Vacuum Dewatering Method Concrete of Thickness 150 mm in locations as marked in Schedule of Finish. The perforation and laying & concrete shall be as per specifications and Method of Vacuum Dewatering. The Preparation of Top surface shall be such it can receive the final coat of 52 mm cement concrete flooring.