

**S 20 - PEB STRUCTURAL STEEL****1**      *Pre-Engineered Building (PEB)***1.1**      General

Pre-engineered Buildings or building components wherever specified shall be designed, supplied and erected by a specialist agency called PEB manufacturer approved by the engineer-in-charge. All codes and standards for material, design, fabrication and erection shall generally be as indicated for structural steel work unless the following specifications call for a deviation otherwise. PEB manufacturer shall use Submerged Arc Welding for built-up sections, meeting the applicable requirements of the American Welding Society (A.W.S) D1.1.98

The agency responsible for design, fabrication and erection shall not be allowed to sub-let any of the activities/operations to another sub-agency in anyway unless a prior written approval of the engineer-in-charge is taken. The agency for PEB should have an ISO 9001 certification for manufacture of PEBs. Contractor shall submit all fabrication design and drawings for approval by GC/KRIDE prior to commencement of fabrication works.

**1.2**      Design Specifications for PEB

The PEB manufacturer shall be responsible for carrying out all the design of PEB's as per following relevant IS codes only.

- a. IS:800 Code of Practice for general construction in steel
- b. IS:801 Cold formed sections
- c. IS:811 Cold formed sections
- d. IS:875 Code of Practice for design loads for building and structure
- e. Latest edition of Vulnerability Atlas of India for multi hazard risk-assessment.

Only in absence of design criteria not available in mentioned IS codes, reference can be made to other international codes/manuals as applicable to PEB's and same shall be subject to approval of KRIDE in case of deviation from IS codes.

The maximum deflection limit for various load combination for various framed structures of PEB's is limited to height/200 and span/200 provided the roofing and

cladding sheets are capable of absorbing this deflection without any deformation/cracks. Responsibility of same shall be given in writing by the PEB's supplier.

The earthquake load for design of PEB should be taken as per IS 1893:2002

The wind load for design of various PEB's should be taken as given in relevant table of IS:875-1987.

The local external wind pressure coefficient should be taken strictly for the local zones as shown in relevant tables of IS 875-1987. The internal and local external coefficients shall be combined for design of roof sheeting, glass panels, individual cladding units and purlins falling in high local pressure zones shown in relevant tables of IS:875-1987.

It's the responsibility of PEB supplier to account for design loads of the cranes, gantries, stringer support beam, solar panels, roof inspection platform etc. in design of PEB's. The connection detail and related accessories/fixtures to fix all above miscellaneous units to PEB frames is also responsibility of PEB supplier. Sufficient strengthening measures shall be taken in the portals due to these loads.

The fabrication drawings along with necessary design calculation for connections etc. should also be submitted by PEB supplier before start of fabrication for KRIDE's approval.

The cold formed sections shall be designed strictly based on IS: 801-1975. The cold formed sections should be designed as stiffened /un-stiffened section based on lip dimension satisfying the section requirements of stiffened/un-stiffened section.

The overlapping of two cold formed sections to enhance section properties is not permitted. At the locations of splicing in the continuous purlins separate splicing piece, suitably designed, shall be provided.

Following items shall be reviewed/clarified and clearance obtained by the PEB supplier before start of design of PEB buildings: -

Plan dimensions of the buildings.

Height of cladding for buildings.

Door opening sizes

Crane load requirement and OHE drop arm loading details.

Specification for painting accounting for exposure condition.

Steel grade for portals and cold formed sections.

Minimum thickness requirements for cold formed sections and structural steel members.

Use of stiffener plates for built-up portals.

Use of HSFG bolts for base connections.

Liberty of using portal spacing to achieve economy providing they satisfy the architectural/operational requirement and door/window opening sizes.



Expansion joint requirements for PEB's.

Pitch for rafter members.

No. of continuous span for design of purlin and roof sheeting.

### 1.3 Responsibilities

It may be noted that the foundation and pedestal upto plinth level shall be constructed by the main civil contractor wherein the anchor bolts for steel columns will be supplied by the PEB manufacturer and the same shall be fixed by main contractor. All the steel work above this level shall be entirely carried out by the PEB manufacturer. All other civil work e.g. flooring, brickwork etc. shall be carried out by the main civil contractor and paid for as per the relevant item of BOQ.

Upon receiving comments on the designs and drawings, PEB manufacturer shall carry out all modifications within the stipulated time schedule and get the same approved before carrying out any activity relating to the same.

Well qualified, approved personnel of the PEB manufacturer shall be available at the site during all operations relating to the PEBs. Qualified personnel of the PEB manufacturer shall carry out the necessary assembly and erection at the site.

All components of PEBs shall be fabricated, manufactured, sand blasted where required and primed at the PEB manufacturer's works. No site fabrication shall be allowed.

### 1.4 Time Schedule of Design and Approval

Immediately upon being awarded the work, the main contractor shall appoint the PEB manufacturer. Complete design calculations including all references, loadings, justification, etc, drawing and details shall be submitted by the Contractor/PEB manufacturer for approval within a month from the date of award of work. The Consultant and/or client will comment upon the same in a suitable time. The Contractor/PEB manufacturer will carry out all modifications and also attend to the KRIDE / GC to sort out their queries necessary for the smooth and timely approval of the designs and drawings. Upon receiving the comments, the contractor/PEB manufacturer will submit their modified designs and drawings within one week for approval.

Immediately after approval, the activities relating to the construction of the PEBs shall be taken up. The cost of designs, drawings including approvals shall be deemed to be included in the rates for PEBs.

A local design office of the PEB supplier is desirable for faster clarifications on the design issues.

### 1.5 Material

Material shall be hot rolled sections, plates, bolts, fasteners, cold formed sections (not less than 2.5mm thick) etc, all as per IS 2062 grade B0 with 345 MPa yield stress. Cold formed sections shall be permitted only for purlins. Thickness of structural steel shall not be less than 8mm except for cold formed purlins.

### 1.6 Measurement for Payment

The measurement for payment shall be the plan area of the building based on the centre line of the peripheral columns. No extra payments shall be made for increase in height of buildings upto +0.5m

## **2 PEB STRUCTURAL STEEL - PAINTING WORKS**

### **2.1 General**

#### **2.1.1 *Scope of Specification***

This Specification covers the scope of painting, methods for the surface preparation, application of paints and precautions to be taken for the painting of structural steel work. It covers the supply and delivery of all necessary materials, labour, scaffolding tools, equipment and everything that is necessary for the job completion on schedule.

#### **2.1.2 *Applicable Codes***

The following Specifications, Standards and Codes are included as part of this Specification. All standards and codes of practice referred to herein shall be the current editions during the currency of project including all applicable official amendments and revisions.

In case of discrepancy between this Specification and those referred to herein, this specification shall govern. In case of discrepancy between Contract drawings and this specification, the Contract drawings shall govern.

- a) IS: 102 (1962) : Ready Mixed Paint, Brushing, Red lead, Non Setting, Priming.
- b) IS: 159 (1981) : Ready Mixed Paint, Brushing, Acid Resisting for. Protection against Acid Fumes, Colour as Required.
- c) IS: 341 (1973) : Black Japan, Types A, B & C.
- d) IS: 384 (1979) : Brushes, Paints and Varnishes, Flat.
- e) IS: 487 (1985) : Brush, Paint and Varnish i) Oval Ferrule Bound ii) Round Ferrule Bound.
- f) IS: 958 (1975) : Temporary Corrosion Preventive Grease, Soft Film, Cold Application
- g) IS: 1153(1975) : Temporary Corrosion Preventive, Fluid, Hard Film, Solvent Deposited.
- h) IS: 1477(1971) : Code of Practice for Painting of Ferrous Metals in Building.  
Part I -Pretreatment  
Part II -Painting
- i) IS: 1674(1960) : Temporary Corrosion Preventive Fluid, Soft Film, Solvent Deposited.

- j) IS: 2074 (1992): Ready Mixed Paints, Red Oxide -Zinc Chrome, Priming.

## 2.2 Products

### 2.2.1 Materials

#### 2.2.1.1 Paint

1. All paint delivered to the fabrication shop/Site shall be ready mixed, in original sealed containers, as packed by the paint manufacturers, and no thinners shall be permitted.
2. Paint shall be stirred frequently to keep the pigment in suspension

#### 2.2.2 Storage of Paints

1. All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flame, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.
2. All paint containers shall be clearly labelled to show paint identification, date of manufacture, batch number, order number and special instructions in legible form. The containers shall be opened only at the time of use. Paints which have liveried, gelled or otherwise deteriorated during storage, shall not be used. Paints for which the shelf life specified by the supplier has expired shall not be used without inspection and approval by the Engineer.

## 2.3 Execution

### 2.3.1 Paint System

- 1 Sand blasting where specified shall be carried out in accordance with IS:1477.
- 2 Painting work shall be carried out as follows:

2. Descripti on	1. General Surface	
	EXTERNAL SURFACES	INTERNAL SURFACES
FABRICATION SHOP		
Surface Treatment	Abrasive blast cleaning to minimum SA-2.5 SIS-055900 near – white blast cleaning	Abrasive blast cleaning to minimum SA-2.5 SIS-055900 near – white blast cleaning
1st Under-Coat	Inorganic zinc silicate primer (self curing solvent type) DFT – 75µm shall be Berger Zinc Anode 11 or approved equivalent. The primer should	Epoxy zinc phosphate primer polyamide cured DFT-35µm

	be applied by spray only.	
2 <sup>nd</sup> Under- Coat	Epoxy zinc phosphate primer polyamide cured DFT-35µm shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.	Epoxy zinc phosphate primer polyamide cured DFT-35µm shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.
3 <sup>rd</sup> Under-coat	Epoxy Zinc Phosphate primer polyamide cured DFT-35µm shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.	Polyamide cured coal tar epoxy coating DFT 100µm
4 <sup>th</sup> Under - Coat	Epoxy high build micaceous iron oxide coating polyamide cured DFT-90µm shall be Berger Epilux 4 High Build MIO. The primer should be applied by spray or brush only.	Polyamide cured coaltar epoxy coating DFT – 100µm
ERECTION SITE		
Intermediate coat	Acrylic polyurethane finish aliphatic isocyanate cured DFT-30µm shall be Berger thane or approved equivalent applied by spray or brush in approved colour.	NA
Finish Coat	Acrylic polyurethane finish aliphatic isocyanate cured DFT-30µm shall be Berger thane or approved equivalent applied by spray or brush in approved colour.	NA

INTERNAL SURFACE = Internal surface are those which will become inaccessible after fabrication. For example the 2/ISMC box section, RHS and SHS sections etc.

EXTERNAL SURFACE = All other surfaces whether they are inside the roof sheeting, inside the workshop or any other locations which are prone to humidity and moisture from the atmosphere.

The following precautions must be taken:

- a. After abrasive blast cleaning, the first undercoat (primer coat) should be applied well before surface deterioration.
- b. At least EPOXY MIO coating application should be completed before giving any long overcoating interval for external surface.
- c. At least up to one coat of coal tar epoxy shall be completed before giving any long overcoating interval for internal surface.
- d. Overcoating intervals, application parameters shall conform to manufacturer's instruction manual.
- e. The DFT (Dry film thickness) shall be measured after completion of each coat.
- f. Do not apply during rains or when temperature is below 10 deg. C or rises above 50deg C or when relative humidity rises above 90%.

### **2.3.2** *Surface Preparation*

#### **2.3.2.1 General**

All surfaces shall be cleaned of loose substances and foreign materials. e. g. dirt, rust, scale, oil, grease, welding flux etc so that the prime coat adheres to the original metal surface. The work shall be carried out in accordance with IS: 1477 (1971) (Part I). Any oil, grease, dust or foreign matter deposited on the surface after preparation shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals. The primer coat shall be applied immediately after the surface preparation is completed.

Before the application of any paint the surfaces to be treated shall be thoroughly cleaned freed from all scale, loose paint, rust and other deleterious matters. Oil and grease shall be removed from the surface by washing with solvents or with a detergent solution before blast cleaning operation of metal polish with metal pellets. If any traces of oil or grease remain after blasting they shall be removed by solvent cleaning and the area will be re-blasted thereafter.

All welding areas shall be given special attention for removal of weld flux slag, weld metal splatter weld head oxides, weld flux fumes silvers and other foreign objects before blasting. If deemed necessary by the Engineer, acid washing and subsequent washing with clean water shall be used.

Any rough seams will have to be ground and must be inspected and approved by the Engineer-in-Charge before application of the coatings.

All structural steel to be painted shall be cleaned blast cleaning in accordance with SA 2 1/2 Near- White Blast cleaning (equivalent Swedish Standard SIS 055900). For SA 2 1/2 the profile should be in the range of 40-70 microns and shall be measured with comparator. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or stripes. Finally the surface shall be cleaned with a vacuum cleaner or clean dry compressed air.

The blast cleaning shall produce a surface roughness complying with the one



specified by the paint manufacturer for the primer concerned. If, cleaned surfaces are rusted or are contaminated with foreign material before painting is accomplished they shall be re-cleaned by the Contractor at his expenses.

The surface shall be cleaned by impingement of abrasive materials, such as grit of cast iron, malleable iron, steel or synthetic material, at high velocity created by clean and dry compressed air blast. Prior to application of the blast, heavy deposits of oil and grease shall be removed by solvent cleaning and excessive surface scale removed by hand tool or power tool cleaning.

The last finish paint shall be applied after structural steel erection and slab construction.

### **2.3.3** *Mixing and Thinning*

1. All ingredients in a paint container shall be thoroughly mixed to break-up lumps and disperse pigments, before use and during application, to maintain homogeneity. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.
2. Dry pigments, pastes, tinting pastes and colours shall be mixed and/or made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.
3. Additives that are received separate such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturers instructions. These shall be promptly used within the pot life specified by the manufacturers and unused paint thereafter shall be discarded.
4. Thinners shall not be used unless essential for proper application of the paint. Where thinners are used, they shall be added during the mixing process and the type and quantity of thinner shall be in accordance with the instructions of paint manufacturer.

### **2.3.4** *Paint Application*

#### **2.3.4.1 General**

1. Paint shall be applied in accordance with the manufacturer recommendations, as supplemented by these Specifications. The work shall generally follow IS:1477 (1971) (Part II). Prior approval of the Engineer shall be taken in respect of all primers and/or paints, before their use in the works.
2. Paint shall generally be applied by brushing except that spraying may be use for finish coats only when brushing may damage the prime coats. Roller coat or other method of paint application shall not be used unless specifically authorized.
3. Spraying paint shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in difficult accessible areas.
4. Paint shall not be applied when the ambient temperature is 10°C and below. For paints which dry by chemical reaction the temperature requirements

specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind, fog or at relative humidity of 80% and above or when the surface temperature is below dew point, resulting in condensation of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying and the damaged area repainted after removal of the paint.

5. Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.
6. Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damages such as lifting or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of same colour shall be tinted. Whenever practical, to produce contrasts and help in identifying the progress of the work.

#### **2.3.4.2** *Brush Application*

1. Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS:487( 1985) are better suited for irregular surfaces, whereas flat brushes which conform to IS:384( 1979) are convenient for large flat areas. The width of flat brushes shall not generally exceed 1.25mm.
2. Paint shall be applied in short strokes depositing a uniform amount of paint in each stroke followed by brushing the paint into all surface irregularities, crevices and corners and finally smoothening or leveling the paint film with long and light strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

#### **2.3.4.3** *Spray Application*

1. The spraying equipments shall be compatible with the paint material and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent before use.
2. The paint shall be applied by holding the gun perpendicular to the surface at a suitable distance and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.
3. Watertrap acceptable to Engineer shall be furnished and installed on all equipment used in spray painting.

#### **2.3.5** *Shop Painting*

1. The painting system specified in Table shall be followed.
2. Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted but require protection shall be given a rust inhibitive grease conforming to IS:958-1975 or solvent deposited compound conforming to IS: 1153 (1975) or IS: 1674 (1960) or treated as specified in the

drawing.

3. Surface to be in contact with concrete shall not be painted.
4. The shop coats shall be continuous over all edges, including ends meant for jointing at site by bolting, except where the paint could be detrimental to bolting. In such cases, no paint shall be applied within 50mm, and the unprotected surface shall be given a coat of corrosion inhibitive compound.
5. The unpainted area shall be cleaned prior to welding. The welded joint shall be cleaned and deslagged, and immediately after covered by the same paint as has been used for the remaining surface.

#### **2.3.6** *Protection of Paintwork*

1. The Contractor shall provide measures as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations. Paint or paint stains which result in other unsightly appearance on surfaces not designated to be painted shall be removed or obliterated by the contractor at his cost.
2. All painted surfaces that in the opinion of the Engineer are damaged in anyway, shall be repaired by the contractor at his cost with materials and to a condition equal to that of the requirements specified in these specifications.
3. Upon painted surfaces that in the opinion of any other work that would cause dust, grease or foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be thoroughly cleaned. At the time of opening the flyovers to public traffic, the painting shall be completed and the surfaces shall be undamaged and clean.
4. The areas for high-strength bolts shall be protected by masking tape against undercoat application at the fabrication shop. Immediately prior to erection any rust in the paint area shall be removed by power wire brushing to a standard equivalent to SA3.

#### **2.3.7** *Site Painting*

1. After the erection of structures at the site, the contractor shall provide the necessary treatment as specified in Table "PAINTING SPECIFICATIONS".
2. Surface which have not been shop coated, but require surface treatment shall be given necessary surface preparation and coats at site as specified in Table.