TENDER DOCUMENT

For

Supply & installation of pre-coated metal sheet cladding system to the gable ends of outdoor sports facility structures inside IIT Bombay, Powai, Mumbai – 400 076

VOLUME – 2 : TECHNICAL SPECIFICATIONS

Tender Number:

_____________________________ 2014
## Technical Specification

### Volume – 2

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SECTION : A

HOT DIP ALUMINIUM-ZINC ALLOY METALLIC COATED STEEL STRIP AND SHEET (PLAIN).

1. SCOPE OF WORK :
  1.1. This covers the requirement of continuously hot-dip aluminium-zinc alloy metallic coated steel strip and sheet (plain) specification of min. 0.50 mm thick base steel.
  1.2. Sheets and coils are produced by uniformly coating over both surfaces of cold rolled steel coil as base.
  1.3. This standard covers requirements for steel grades, coating classes and surface finishes as follows:
      a) Normal (N)/Skin-passed (S);
      b) Aluminium/Zinc coating classes; and
      c) Structural steel grades

2. REFERENCES
   The following standards contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<table>
<thead>
<tr>
<th>IS. No.</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>513 : 2008</td>
<td>Cold reduced low carbon steel sheet and strip (fifth revision)</td>
</tr>
<tr>
<td>1608 : 2005</td>
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</tr>
</tbody>
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3. TERMINOLOGY
   For the purpose of this standard the definition given in IS 1956 (Part 4) and the following shall apply.

3.1 Cold Reduced Sheet or Coil — Cold reduced sheet or coil prior to hot-dip coating process.

3.2 Thickness of Sheet — Thickness of cold reduced sheet in cut-length or coil form without any coating on it. This is also termed as BMT (base metal thickness). In case of coated steel, it is measured after removing the coating. This is the thickness on which structure is designed and should be used while ordering the coated steel.

3.3 Coated Thickness — Thickness of coated sheet in cut-length or coil form. This is also termed as TCT (total coated thickness).

3.4 Aluminium/Zinc Alloy Coating — A hot-dip coating composed of 55 percent aluminium, balance zinc
and incorporating minor addition of control elements. This type of coating normally has a post treatment for perseverance.

3.5 Surface Finish
3.5.1 Normal
The un-altered 55 percent aluminium zinc crystal structure that occurs during solidification of a hot-dip coated steel sheet. It will be denoted by N (Normal).

3.5.2 Skin Passed
The material is skin passed for improved surface condition to make it suitable for subsequent painting and it will be denoted by S (Skin passed).

3.6 Coating Class — The designation of coating class shall include a set of characters as follows:
Aluminium zinc alloy shall be indicated by the prefix ‘AZ’, followed by a number representing the minimum coating mass, in g/m2, of sheets or strips (total for both surfaces determined by triple spot test/on-line X-ray fluorescence method.
Example : ‘AZ150’

3.7 Steel Grade — The designation of steel grade shall include a set of characters as follows:
a)First and second characters: to indicate yield strength ‘YS’.
b)Third, fourth and fifth characters: to represent the minimum yield strength in MPa, namely‘250’, ‘300’, ‘350’, ‘450’ and ‘550’.
Example: ‘YS 550’

3.8 Surface Treatment Condition — Coated steel surface maybe given passivation treatment or other additional coating. This condition will designated as ‘T’.

4. SUPPLY OF MATERIAL
The general requirements relating to supply of aluminium-zinc alloy metallic coated steel strip and sheet (plain) shall conform to IS 8910.
The coated steel to this standard may be supplied in surface finish normal (regular spangle)/skin-passed based on mutual agreement between the purchaser and the supplier.

5. MANUFACTURE
5.1 The base metal of cold-rolled low carbon steel strip for aluminium-zinc alloy metallic coated steel strip and sheet (plain) shall be as per IS 513.

5.2 Coating is done by dipping the cold-rolled strip in a bath of molten aluminum, zinc and control elements at a temperature suitable to produce a complete and uniformly adhering aluminium-zinc alloy metallic coating.

5.3 Coated surface may be given treatment like temper mill pass, surface passivation or other coating for different beneficial reasons

6. PRODUCT DESIGNATION
The product designation shall follow the following sequence :
a) Number of this standard (IS);
b) Steel grade;
c) Coating class;
d) Surface finish; and
e) Surface treatment condition (passivated, other coating, etc).

Example: IS 15961 -200Y YS550 AZ150 NT

7. CHEMICAL COMPOSITION
7.1 Requirements for chemical composition of the base steel shall be as per IS 513.
7.2 One sample/heat of the base metal to be tested after stripping the coating from it.

8. TENSILE TEST
8.1 Test Piece
The tensile test piece shall be cut parallel to the direction of rolling
8.2 Testing Frequency
Sample shall be collected and tested for each mother cold-rolled coil and the part thereof as per agreement between the supplier and the purchaser
8.3 Testing
When tested as per IS 1608, the tensile properties should be as per the Table 1. (Testing is preferred on dumb-bell shaped tensile samples.) Width of the dumb- bell to be 12.5 mm for 50 mm \( L_0 \) and 20 mm for 80 mm \( L_0 \). Testing shall be carried out at ambient temperature between 10 and 35°C.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Grade Designation</th>
<th>Yield Strength MPa ( Min ) (see Note 2)</th>
<th>Tensile Strength MPa</th>
<th>Minimum Percent Elongation ( L_0-50 ) mm</th>
<th>Minimum Percent Elongation ( L_0-80 ) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(i) YS250</td>
<td>250</td>
<td>320</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>(ii)</td>
<td>YS300</td>
<td>300</td>
<td>340</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>(iii)</td>
<td>YS350</td>
<td>350</td>
<td>420</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>(iv)</td>
<td>YS450</td>
<td>450</td>
<td>480</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>(v)</td>
<td>YS550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td></td>
</tr>
</tbody>
</table>

Notes
1. Test specimen to be tested with coating intact, in alignment with international norms the base metal thickness will be used for calculation of strength.
2. The yield strength is the lower yield stress. If well defined yielding is not obvious, then 0.2 percent proof stress should be determined.
3. \( L_0 \) stands for original gauge length.
4. Applies to test piece equal to or greater than 0.60 mm thick.
9. **COATING TEST**

9.1 Triple spot test to be done by X-ray fluorescence method (see IS 12860) or weight loss (Gravimetric) method to comply the requirement of this standard. The weight loss test shall be conducted as per Annex A. The minimum coating weight shall be as per Table 2 when tested as per 9.2 to 9.7.

9.2 One set of three samples each at least 50 × 50 mm² or 50 mm diameter shall be selected at random from one sheet for every lot of 1000 sheets, or part thereof. In case of material supplied in coil form, one set of three samples each of 50 × 50 mm² or 50 mm diameter shall be selected from one end of each coil lot. However, if there is any process interruption or change in coating weight or change in grade, then coating shall be tested each change/interruption.

9.3 This set of three samples in total shall be taken one each from the middle of the width of the sheet, and one from each edge of the sheet. The samples from extremities, diagonal or from the side of the sheet shall not be closer than 25 mm from the edge of the sheet.

9.4 One Surface Single Spot Coating Mass The minimum coating mass on any one surface of any of the three specimens used for triple spot test.

9.5 **Single Spot Coating Mass**

The minimum coating mass on any one of the three specimens used for triple spot test.

9.6 **Triple Spot Coating Mass**

The average of three specimens selected from a sample representing the original cross-section of the sheet and strip.

9.7 **Differential Coating**

A coating which has a substantially different coating mass on each side of the steel sheet or strip. This shall be as per agreement between the purchaser and the supplier.

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### Table 2 Coating Class and Coating Mass

(Clauses 9.1)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Coating Class</th>
<th>Minimum Coating Mass, g/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Both Surfaces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Triple Spot</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>(i)</td>
<td>AZ200</td>
<td>200</td>
</tr>
<tr>
<td>(ii)</td>
<td>AZ150</td>
<td>150</td>
</tr>
<tr>
<td>(iii)</td>
<td>AZ100</td>
<td>100</td>
</tr>
<tr>
<td>(iv)</td>
<td>AZ70</td>
<td>70</td>
</tr>
</tbody>
</table>

**NOTE**
Coating weight other than the above shall be a matter of mutual agreement between the customer and the supplier.
10. **COATING ADHESION TEST**
   One test specimen per coil is to be tested from any part of the sample. Minimum test specimen width shall be 50 mm. Both surfaces of the test specimen shall be capable of being bent 180° around a mandrel with diameter specified in following table without flaking of coating. Failure of coating within 5 mm of the edge of the test specimen shall be disregarded. This will be in accordance with Table 3.

11. **FREEDOM FROM DEFECTS**
11.1 Plain sheets and coils shall be reasonably flat and free from bare spots, holes, tears and other harmful defects.

### Table 3 Coating Adhesion
(Clauses 10)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Steel Grade Designation</th>
<th>Diameter of Mandrel in Terms of Thickness (t) of the Product Coating Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>(i)</td>
<td>YS250</td>
<td>t</td>
</tr>
<tr>
<td>(ii)</td>
<td>YS300</td>
<td>t</td>
</tr>
<tr>
<td>(iii)</td>
<td>YS350</td>
<td>t</td>
</tr>
<tr>
<td>(iv)</td>
<td>YS450</td>
<td>2t</td>
</tr>
<tr>
<td>(v)</td>
<td>YS550</td>
<td>2t</td>
</tr>
</tbody>
</table>

**NOTE**
0 indicates that the coated sample is bent flat on itself

11.2 However, coils may contain some abnormal imperfection which may render a portion of the coil unusable since imperfections in the coil cannot be removed as in the case with cut length.

12. **MASS**
The actual mass of the sheets or coils shall be mentioned in ‘kg’ or ‘t’.

13. **DIMENSIONS, SHAPE AND TOLERANCES**
13.1 **Coil Internal Diameter**
   Unless otherwise agreed, internal diameter of coils shall be 508 mm (±10 mm).
13.2 **Length Tolerance**
   In the case of sheet — No sheet shall be smaller in length than specified. Tolerance on length on plus side shall be 15 mm or 0.5 percent of length, whichever is greater.
13.3 **Width Tolerance**
   Width of the finished product shall not be smaller than specified. Plus side tolerance on untrimmed width shall be 10 mm. In case of trimmed width it will be plus 3 mm, Max.
13.4 **Thickness Tolerance**
The tolerance on thickness of sheet and coil shall be as per IS/ISO 16163.
13.5 **Camber**
   Minimum camber values for coils and sheets shall be as given in IS/ISO 16163.
13.6 **Deviation from Squareness (Out-of Square)**  
The diagonal distance between opposite corners of any sheet shall not differ by more than 10 mm.

13.7 **Deviation from Flatness (Steepness)**  
This will be in accordance with Table 4.

<table>
<thead>
<tr>
<th>Steepness Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>1.2</td>
</tr>
</tbody>
</table>

**NOTE** —  
Class A tolerance, where length between the points of contact is less than 1 000 mm, the steepness percentage will be 1.

14. **RE-TESTING**  
When a part of the test results for physical properties fails to comply with the requirement, a re-test (two more sets of test samples shall be taken for specific test requirements from the same lot) on the relevant items may be carried out to determine whether it is acceptable or not. If any of the re-test samples fail to meet the test requirements of this standard, the lot represented by the sample shall be deemed as not conforming to this standard.

15. **PACKING**  
Coils/Sheets should be suitably packed to avoid any transit/handling/storage damage

16. **MARKING**  
16.1 The following shall be legibly and indelibly marked on the top of each coil or package of sheets or shown on a tag attached to each coil or packet:
   a) IS No. of this standard;
   b) Manufacturer’s name or trade-mark;
   c) Material identification/coil number/packet number/batch number, etc;
   d) Product dimensions;
   e) Number of sheets or mass;
   f) Steel grade;
   g) Coating class; and
   h) Date of manufacture.

16.2 **BIS Certification Marking**  
The material may also be marked with the Standard Mark.

16.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986*
and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.
ANNEX A  
(Clause 9.1) 

METHOD OF COATING WEIGHT DETERMINATION BY WEIGHT LOSS METHOD

A-1 CHEMICALS AND APPARATUS REQUIRED

a) Hydrochloric acid (1+1) — Mix 500 ml of HCL (sp gr. 1.19) with 500 ml of reagent water;
b) Reagent water shall be prepared by distillation ion exchange/continuous electro deionisation/reverse osmosis/electro-dialysis or combination thereof;
c) Solvent naphtha;
d) Alcohol;
e) Weighing balance (least count 0.01g minimum); and
f) Dryer.

A-2 PROCEDURE

Clean the accurately prepared specimens by washing with solvent naphtha (or other suitable solvent), and
a) rinse with alcohol, and dry thoroughly;
b) determine the weight (mass) of the specimens individually to the nearest 0.01 g;
c) immerse each specimen in the stripping solution and allow remaining there until the violent evolution of the hydrogen has ceased, and only few bubbles are being evolved. This requires 15 to 30 s. The same solution may be used repeatedly until the time for required for stripping becomes inconveniently long;
d) the temperature of the stripping solution shall at no time exceed the temperature of 38 °C. After stripping, wash the specimens by scrubbing them under running water, dip in hot water and wipe or blow dry;
e) determine the weight (mass) of the specimens again, to the same precision as in the initial determination; and
f) determine the coating mass as per the following calculation.

When determining coating weight (mass) on one side of sheet material, use the above procedure except the use of stop-off). To protect one side from the stripping medium, a few common examples are acid resistant paints or acid resistant tapes. Apply the stop off to the specimen after weighing initially and remove it before taking weight after the stripping of the coating. There is always a possibility of moisture absorption, so the stop off should not be there during the weight determination. The coating weight on the other side may be determined subsequently without a stop off on the first side.
C = \left[ \frac{(W_1 - W_2)}{A} \right] \times K

where

- **C** = weight (mass) of coating of sheet, in g/m\(^2\);
- **W_1** = original weight (mass) of the specimen, in g;
- **W_2** = weight of stripped specimen, in g;
- **A** = area of sheet, in mm\(^2\); and
- **K** = \(1 \times 10^6\)

*******
SECTION : B

COMPOSITE WALL CLADDING

General

1. Design Criteria

1.1. Design panel wall to provide for thermal movement of component materials caused by ambient temperature range of 5 to 85 °C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

1.2. Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

1.3. Design members to withstand dead load and wind loads calculated in accordance with NBC and applicable local regulation, to maximum allowable deflection of 1/180th of span.

1.4. Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC “Rain Screen Principles”.

1.5. Design wall system to accommodate specified erection tolerances of structure.

1.6. Design wall system to allow for movement of air between exterior and interior side of cladding.

2. Samples

2.1. Submit samples.

2.2. Submit duplicate 300mm x 300mm samples of wall system, representative of materials, finishes and colours.

3. Shop Drawings

3.1. Submit shop drawings.

3.2. Indicate dimensions, wall openings, window and door head, jamb, and sill detail, corner detail, materials and finish, fastening details, compliance with design criteria and requirements of related work.

4. Qualification Of Installer

4.1. Application of cladding system to be by installers approved by manufacturer of system specified, in strict accordance with manufacturer’s written “Installation Guide”.

5. Mock-Up

5.1. Provide a mock-up on building consisting of complete cladding system, including but not limited to metal furring, panels, securement devices, sealants and moulding for approval. Cladding finish and mouldings to be of finish and colour as designated by the Façade Consultant.

5.2. Location of mock-up to be as directed by Façade Consultant. Size to be four panels minimum in a 2 over 2 configuration.

5.3. Modify mock-up as necessary for Façade Consultant approval. Mock-up may / may not remain in place as part of completed work, as directed by the Façade Consultant. Mock-up to represent standard for completed work.

6. Maintenance Data

7. Extended Warranty

7.1. Provide 10 year extended warranty, from date of certificate of substantial performance of work, against manufacturing defects which result in cracking, crumbling, chipping, or abnormal colour fading under usual environmental conditions.

8. Products

8.1. Specify panel size(s), texture, finish and colour from manufacturer’s literature and colour samples. Standard thickness is 4mm thick.

9. Materials

9.1. Aluminium Composite Material: PVDF finished 0.5mm thick aluminium outer sheet, 3mm thick core and 0.5mm thick aluminium chromated inner sheet.

9.2. Wall cladding system: Open groove system in compliance with Rain Screen Principal.

9.3. Fasteners: stainless steel, purpose made, self-tapping, minimum 19 mm (3/4") length, with heads minimum 12 mm (7/16") diameter.

9.4. Sealants: Non staining sealant as approved Façade Consultant.

9.5. Accessories: panel manufacturer’s standard accessories as required by job conditions.

10. Fabrication

10.1. Panels to be moulded under high pressure and high temperature with interlocking joints having rain screen design.

10.2. Coordinate and verify at job site dimensions affecting work of this Section. Ensure suitability of adjacent building components in relation to work of this section.

10.3. Accurately fit joints and intersecting members to true planes adequately and securely fastened and made completely watertight. Component fastening devices shall be of adequate strength and concealed, except as specified otherwise.

10.4. Fabricate units to profile and sizes indicated complete with rabbets, interlocks, flashings, cappings, trim, filler sections as required to interface with work of other sections.

10.5. Fabricate all devices required for erection and adequate anchorage and attachment required to be built into or attached to substrate and framing members for proper support.

10.6. Accurately cut and form flashing true and straight without waves or buckles. Make adequate provision for thermal movement and make joints watertight.

10.7. Cut and flash at openings where shown on Drawings.

10.8. Reinforce work of this section to meet specified requirements and prevent undue deflection. Provide concealed corrosion resistant fastening and continuous formed retaining moulding.

Execution

11. Inspection

11.1. Before installation, examine horizontal and vertical alignment of substrate and notify Façade Consultant in writing if substrate does not comply with panel manufacturer’s requirements.

11.2. Verify compatibility of different metallic surfaces in contact with each other to protect against electro-chemical corrosion.
12. Preparation
12.1. Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.

13. Installation
13.1. Installation to be by manufacturer’s trained and approved installers and in strict accordance with manufacturer’s written recommendations and shop drawings.
13.2. Provide supplemental steel support members for work of this section to suit design requirements.
13.3. Provide work to resist wind uplift at soffits.
13.4. Install metal furring horizontally to substrate at centres corresponding to horizontal joint spacing of panels. Secure at 406 mm (16”) o.c. and to suit loading requirements.
13.5. Ensure all flashing and trim is installed before or immediately after erecting panels, and sealed to stop direct weather penetration.
13.6. Mount panels horizontally working from bottom to top, and each row from left to right in accordance with tongue and groove interlocking system.
13.7. Employ aligned joint technique panel design. Obtain panel symmetry whenever possible relative to openings e.g. doors and windows.

14. Control / Expansion Joints
14.1. Construct expansion joints as required.
14.2. Use mechanical fasteners to secure sheet materials.
14.3. Assemble and secure wall system to substrate on structural frame so stresses on sealants are within manufacturer’s recommended limits.

15. Tolerances
15.1. Maintain following installation tolerances :
15.1.1. Maximum variation from plane or location shown on approved shop drawings :10mm per 10m in length (3/8” per 30’-0”)
15.1.2. And up to 20 mm per 100m in length (3/4” per 300’-0”).
15.1.3. 2° Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm (1/32”).

16. Cleaning
16.1. Wash down exposed exterior surface using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
16.2. Remove excess sealant with recommended solvent.

*********
SECTION : C

STRUCTURAL STEEL WORK:

1. SCOPE OF WORK:

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

2. MATERIALS:

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

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

3. WORKMANSHIP:

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

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

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

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

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

Figured dimensions on the drawings shall be taken.

4. ERECTION AND MARKING:

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

Any part which do not fit accurately or which are not in accordance with the drawings and specifications shall be liable to rejection and if rejected, shall be at once be made good.
Engineer-in-Charge shall have full liberty at all reasonable times to enter the contractors premises for the purpose of inspecting the work and no work shall be taken down, painted or despatched until it has been inspected and passed. The contractor shall supply free of charge all labour and tools required for testing of work.

5. DELIVERY AT SITE :

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

6. SHOP DRAWINGS :

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

7. PAINTING :

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

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

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

8. WELDING :


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

Filler rods and wires for gas welding shall conform to I.S. 1278-1972.

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

The filler rods and bare electrodes for gas shielded metal, arc welding shall conform to I.S. 6419-1971 and I.S. 6560-1972 as appropriate.
8.2 Types of Welding: Arc welding (direct or alternating current) or Oxyacetylene welding may be used. Field welding may be used. Field welding shall be by D.C.

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

<table>
<thead>
<tr>
<th>Average thickness of plate or section</th>
<th>Maximum gauge or diameter of electrodes to be used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3/16”</td>
<td>10 S.W.G.</td>
</tr>
<tr>
<td>3/16” and above but less than 5/16”</td>
<td>8 S.W.G.</td>
</tr>
<tr>
<td>5/16” and above but less than 3/8”</td>
<td>6 S.W.G.</td>
</tr>
<tr>
<td>3/8” and above but less than 5/8”</td>
<td>4 S.W.G.</td>
</tr>
<tr>
<td>5/8” and above but less than 1”</td>
<td>5/1 6”dia.</td>
</tr>
<tr>
<td>1” and above thick section</td>
<td>3/8” dia.</td>
</tr>
</tbody>
</table>

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

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

8.5 Welding Procedure:

a) Welding should be done with the structural steel in flat position in a down hand manner wherever possible. Adequate steps shall be taken to maintain the correct arc length, rate of travel, current and polarity for the type of electrode and nature of work. Welding plant capacity shall be adequate to carry out the welding procedure laid down. Adequate means of measuring the current shall be available either as a part of the welding plant or by the provision of a portable ammeter. In checking the welding current, a tolerance of 10% or 30 amperes from the specified value whichever is less shall be permitted.

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

9. WORKMANSHIP:

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

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

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

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

**Throat Thickness of Fillet**

<table>
<thead>
<tr>
<th>Angle between fusion faces</th>
<th>60°-90°</th>
<th>91°-100°</th>
<th>101°-106°</th>
<th>107°-113°</th>
<th>114°-120°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throat thickness in cms.</td>
<td>0.70</td>
<td>0.65</td>
<td>0.60</td>
<td>0.55</td>
<td>0.50</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

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

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

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SECTION : D

PLASTER WORK:

1. SCOPE OF WORK :

The work covered under these specifications consists of supplying all materials and rendering all types of plaster/pointing finishes strictly in accordance with these specifications, applicable drawings etc. For all finishing works mentioned above, only blended cement shall be a used.

2. GENERAL :

Blended cement, sand and water required for the work shall conform to specifications laid down herein before under chapter 4 i.e. Plain and reinforced cement concrete, except that sand for finishing coat shall be fine sand conforming to I.S. 1542. The plastering works shall generally conform to I.S. 1661 (Pt. III) (Code of practice for cement and cement plaster finish on walls and ceilings). All general precautions as specified in I.S. 1661 (Pt. III) clause-8, shall be taken and preparation of the back ground shall be done as laid down in I.S. 1661 clause 12 and I.S. 2402 shall be generally followed for rough cast and sand faced plaster work. Scaffolding required for facility of working shall be provided by the contractor at his own cost. This may be double or single according to the requirement and shall be approved by the Engineer-in-Charge. Stage scaffolding shall be erected when ceiling plastering is done. The contractor shall be responsible for accidents, if any, take place. The contractor shall co-operate with the other agencies also. Whenever electrical contractor/agency has to fix up switch boxes in walls, necessary Thiyyas, Tapanish or Dhadas shall be arranged to be given in advance of actual plastering process at these locations so that the boxes are fixed properly in line with finished plaster surface. All finishing in and around these boxes as also around the conduit boxes in ceiling shall be done by plastering contractor without any extra cost to the Department. The decision of the Engineer-in-Charge in this regard shall be final and binding on the contractor.

3. PREPARATION OF SURFACE :

The surface to be plastered shall first be thoroughly cleaned of all muck and cleaned down. All joints shall be raked out in case of brick work / stone masonry and closely hacked in case of concrete, under the relevant masonry / concrete items. The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing the work. The mortar for all plaster work shall be blended cement mortar of mix as specified in the schedule of quantities.

After erection of scaffolding and before commencement of plastering work, top most junctions/joints/sides with beam/column shall be thoroughly packed with blended cement mortar to prevent cracks.

Before commencement of plastering operation, the contractor shall ensure that all the service pipes, electrical conduits, boxes, switch boxes etc. have been installed in position by other agencies and the plastering surface is duly approved by the Engineer-in-Charge. In order to enable other service contractors to fix the electrical conduits, conduit boxes, EDBs, pipes, outlets etc. in proper level and line with reference to the finished surface of the plaster, Thiyyas and Tapanis i.e. finished plaster patches shall be given by the
The grooves shall be of required dimensions. The same shall be made to turn wherever necessary. The finish, inside, shall be of the same finish as that of the plaster. The lines of the grooves shall be well defined and rounded. The grooves are to be provided in plastering in internal and external surfaces and shall be paid extra in the rates given in schedule of quantities.
5. MIX PROPORTIONS :

The mortar for plastering shall be of proportion as specified in the item schedule. The mixes specified in the schedule are volumetric.

6. MIXING :

Cement and fine aggregates shall be mixed dry in the required proportions to obtain a uniform colour. Water shall then be added to get the required consistency for the plaster.

Mixing shall be done mechanically. However, manual mixing will be allowed only in exceptional circumstances at the discretion of the Engineer-in-Charge. Manual mixing, where adopted, shall be carried out on a clean water tight platform. After water is added during mixing, the mix shall be held back and forth for 10 to 15 minutes.

In machine mixing, the mixer shall run atleast five minutes after placing all the ingredients in the drum. Only so much quantity of mortar which can be used within half an hour after the addition of water shall be prepared at a time. Any mortar for plaster which is set or partially set shall be rejected & shall be removed forthwith from the site.

6 / 12 / 15 MM. PLASTER :

The plaster shall be laid with somewhat more than 12 mm. thickness and pressed and levelled with wooden ruler to a finished thickness of 12 mm. Straight edges shall be freely used to ensure a perfectly even surface. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Note: For 6mm plaster, approved bonding agent shall be used as per manufacturer’s specifications, wherever specified in the Schedule of Items.

20 MM PLASTER :

The proportions of sand and cement shall be as specified and shall cover all irregularities, undulations, depressions due to chasing etc. in the surface to be plastered. The mortar shall be applied slightly more than 20 mm. thick and pressed and levelled with wooden ruler or straight edge to finished thickness of 20 mm. Straight edges shall be freely used to ensure a perfectly even surface. The finished surface shall be true and even and present uniform texture throughout and all joining marks shall be eliminated. All corners, edges and angles shall be made perfectly to line, plane and plumb. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Plastering items amongst all other things as described in various items also include:

i) Preparation of surfaces to receive the plaster, providing cement plaster of the specified average thickness and proportions with specified number of coats.
ii) All labour, materials, scaffolding, use of tools and equipment to complete the plastering work as per specifications.

iii) Curing for 10 days.

iv) Cleaning the surface of doors, windows, floors or any other surfaces where plastering might have splashed.

v) Finishing the portion of plaster left above the terrazo, plain cement tiles, ironite or any type of skirting work to be finished rounded or as directed by the Engineer-in-Charge, in a separate operation after laying of floor tiles skirting.

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PREAMBLE:

1) All materials shall conform to relevant technical specifications of Volume – 2 of the Tender document. The materials shall be further subjected to tests in the recognized laboratories at the sole discretion of the Engineer-in-Charge and shall be at contractor’s cost.

2) Materials bearing appropriate IS marking and having valid licence for last 3 years shall be given preference while selecting for the work.

3) In case of materials which are not widely available with IS marking in the market but conform to the technical specifications mentioned in the Tender Documents, the same shall be procured from any of the manufacturer listed below after prior written approval of the EIC.

4) Cement for work shall have relevant IS marking and shall be subject to tests in the recognized laboratories and shall be at contractor’s cost.

5) EIC can approve any other brand subject to verification of the adherence to the relevant technical specifications.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Approved Makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cement (Grey)</td>
<td>ACC/L&amp;T/J.K / BIRLA / Vasvdatta, Ambuja and other ISI marked make</td>
</tr>
<tr>
<td>2.</td>
<td>Structural steel</td>
<td>SAIL/TATA/JRINL/IISCO/ Vizag</td>
</tr>
<tr>
<td>3.</td>
<td>Enamel Paint</td>
<td>Asian Paints / ICI</td>
</tr>
<tr>
<td>4.</td>
<td>Aluminium Section</td>
<td>Jindal / Hindalco / Agarvanshi / Geeta</td>
</tr>
<tr>
<td>5.</td>
<td>Weather Sealant</td>
<td>Sika / DowCorning / Momentive / GE</td>
</tr>
<tr>
<td>6.</td>
<td>Structural Sealant</td>
<td>Sika / DowCorning / Momentive / GE</td>
</tr>
<tr>
<td>7.</td>
<td>ACP</td>
<td>Alucobond / Aludcor / Alstrong</td>
</tr>
<tr>
<td>8.</td>
<td>Solid Aluminium Sheet</td>
<td>Novelis / DWALL Metallic</td>
</tr>
</tbody>
</table>