



**GUJARAT INDUSTRIES POWER COMPANY LIMITED
SURAT LIGNITE POWER PLANT (SLPP)**

VOLUME II — STRUCTUAL TECHNICAL SPECIFICATION (PACKAGE A, B & C)

Design, Engineering, Supply, and Construction of Package A, B, C & D
**New Lignite Feeding System, Associated Works, Contingency Feeding Arrangement &
Dismantling**

Tender No.: GIPCL/SLPP/R&M/LHS/FB-RE/LOCATION/EPC/2026

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(SECTION 1A) STEEL STRUCTURES

1. GENERAL

- 1) Design of structural steel work shall include generally but not be limited to the steel constructions listed below:
 - i) Steel building structure and open structures:
This shall include beams, columns, bracings, supporting structures for floors, roof slabs, cladding etc.
 - ii) Crane, gantry, girder, monorails etc.
 - iii) Pipe and cable racks
 - iv) Galvanised latticed/tubular structures for switchyard and transformer yard.
 - v) Platforms and walkways
 - vi) Ladders, staircases, handrails etc

2. FRAMING

- 1) All steel framed structures shall be either "rigid frame" or "simple space frames" or a combination of the two.
- 2) Lateral forces shall be resisted by stiff jointed moment connections in rigid frame design. The column bases shall generally be fixed to concrete foundation pedestal by providing moment resistant base detail.
- 3) Concrete floors shall be considered to provide continuous lateral support to the top (compression) flange of the support beams. However where large cut outs are provided in the floor slabs horizontal floor bracing shall be provided. Grating / chequered plate floor shall neither be considered to provide lateral support to the top flange of supporting beams nor to provide a shear diaphragm. Adequate lateral support and horizontal bracing shall be provided as required in such cases.
- 4) Floors for vibrating machines of all kind together with supporting framework shall be adequately braced in both horizontal and vertical planes. Floors or structure supporting mechanical equipment shall be designed to minimise vibration, avoid resonance and maintain alignment and level.
- 5) Columns shall be designed to support the load combination, which produces the maximum interaction ratio. Exterior columns shall be designed to resist wind moments between braced elevation as appropriate. Columns shall also be designed to resist moments caused by discontinuous vertical bracing or non-concentric bracing work points.

3. MATERIALS



- 1) Materials for structural steel /Translucent sheets/Steel tubes etc shall be as per the detailed technical specifications
- 2) Chequered plates shall conform to IS:3502. All gratings shall be pressure locked type (preferably electro-forged) manufactured in accordance with applicable Indian Standard Codes. Pipes for handrail shall be as per medium grade of IS:1161.
- 3) Bolts, nuts, washers etc. will also conform to the stipulation mentioned in IS:802 (1977). Fabrication galvanized, Erection Inspection, packing and testing. These will conform to the stipulation of IS: 802 (1977)

4. CONNECTIONS

- 1) Welding shall be used for shop fabrication and joints. For site connections, welding or high strength friction grip (HSFG) type bolts shall be used, except in few cases for shear connections of lighter members or removable beam connections where bolted joints may be adopted e.g. purlins, side girts etc. Minimum two bolts of diameter not less than 16 mm per connection shall be used.
- 2) IS: 816 and IS: 9595 shall be followed for welding of structures.
- 3) For high strength friction grip bolt connections IS:4000 shall be followed. High strength friction grip bolts shall be of property class 6.6 or 8.8 and shall conform to IS: 3757 and shall not be less than 20 mm in diameter unless designated otherwise. High strength bolts shall be installed as bearing type joint except where loads are reversible.
- 4) All bolted connections shall have bolts of minimum 16 mm diameter. The connections of stairs and handrails shall be made with 20 mm diameter threaded fasteners conforming to IS:1363. Erection bolts shall be black bolts of minimum 12 mm diameter.
- 5) All bolts and nuts shall have property class compatible to each other. For bolts carrying dynamic or fluctuating loads and those in direct tension shall be provided with an additional double coil helical spring washer conforming to IS:6755. The threaded portion of the bolt shall project through the nut at least by one thread.
- 6) Where a steel beam or member is to be connected on RCC structure, it shall be connected using an insert plate and preferably through shear connection.
- 7) Where practical, the working point of the bracing connection shall be the centre of column and girder to which it connects. The connections of gusset plates to column and girders shall be made to include provisions for eccentricity in connection. The double angle back-to-back with gusset plate in between shall not be used in dust laden areas. Where double angles are not adequate, beam sections with web in the plane of bracing shall be used.
- 8) Horizontal bracings shall be of angle / tee section located at the bottom of framing beams. Field welding /bolting of bracing at the underside of beam as required to meet slenderness requirement of bracing member shall be indicated on the drawings. Horizontal bracing shall be arranged to avoid framing into the beams at column locations.
- 9) 4.10 For Major columns of main building, column splices shall be designed to resist 1.05 times the tensile capacity of the smaller section at the splice joint. Field splicing will be done with web/flange cover plate after UT/ RT of But joint.



- 10) Minimum size of fillet weld shall be 6 mm. Main structural elements shall be welded continuously. Intermittent weld shall be used only on secondary members, which are not exposed to weather or other corrosive influence.
- 11) Efficiency of site welds to be considered shall be as follows:
 - a) Butt weld above 25 m from ground --- 50%
 - b) Others --- 80%
- 12) 4.13 Welding of plates 10 mm and above thickness shall be welded with 7018 electrode. It shall be heated properly in oven before welding.

5. DESIGN METHODOLOGY

- 1) The Design of steel structures shall be in accordance with the provisions of IS: 800 and other relevant IS codes as applicable to specific structures.
- 2) All buildings / structures shall be framed structure. Basic consideration for structural framing shall be stability, rigidity, building usage, ease of fabrication / erection and overall economy. Additional bracings / moment connections shall be used to assure stability of structures. Structure shall be designed such that the surfaces of all parts shall be accessible for inspection, cleaning, painting and maintenance.
- 3) For lifting / monorails beams ISMB sections shall be preferred and the bottom flange of all beams shall be checked separately for distortion and reinforced suitably if required.
- 4) Permissible stresses for different members shall not be allowed to exceed by 33.33% under wind and seismic conditions. However, members which are designed primarily to resist wind load such as bracing members, no increase in permissible stresses will be permitted. However, permissible stresses in bolts and welds shall be allowed to exceed up to 25 % only.
- 5) For design which requires the use of the minimum column load (such as, uplift on anchor bolts, column axial tension, etc.) the following criteria shall be used in determining minimum load. Use 90% of the column dead load, No live load is to be used, Uplift forces from vertical bracing are included where applicable and Wind uplift on the roof is included where applicable.
- 6) Base plates shall be placed on foundation pedestal with grouting. For large base plates necessary grout holes shall be provided. All anchor bolts for fastening steel columns on foundation shall be embedded in foundation during concreting itself. No anchor pockets in foundation shall be allowed. Design of base plates shall be based on design pressure on foundation which shall not exceed 0.25fck if working stress is adopted and 0.45fck when limit state method is adopted where fck is the characteristic strength of concrete as per IS456. The allowable bearing pressure are as following:

	Working stress	limit state
Pedestal in concrete grade M25	6.25 N / sq.mm	11.25 N / sq.mm
Pedestal in concrete grade M30	7.5 N / sq.mm	13.5 N / sq.mm
- 7) The total horizontal shear force at the base of column is transferred to the column pedestals through friction between the base plate and the grout. A coefficient of friction of 0.30 shall

be used in conjunction with the minimum column load as defined above. If the horizontal shear force exceeds the frictional resistance force or if the column is subjected to a net uplift load, the total force shall then be transmitted through shear bars / shear keys welded to the base plate. Anchor bolts are not assumed to resist any horizontal shear force. Necessary recesses shall be kept in the foundation concrete for shear lugs.

- 8) The following criteria shall be followed for posting loads on the design drawings. For vertical beam reactions, the load shall be posted whenever the value exceeds the maximum allowable uniform distributed load. For axial loads in floor beams, the actual horizontal load which the beam end connection must resist shall be posted for each end of the beam. Note that this value may be different for opposite end of the same beam. For truss members, only one-member force shall be noted for each member.

6. PERMISSIBLE DEFLECTIONS

- 1) The permissible deflections of various steel members under normal loading conditions shall be as specified below. For calculation of deflections in structures and individual members dynamic effects shall not be considered, unless specified otherwise. Also, no increase in deflection limits shall be allowed when wind or seismic loads are acting concurrent with normal loading conditions.

2) **Vertical Deflection:**

- | | |
|--|------------------------------|
| a) For beams supporting dynamic equipment | : Span / 500 |
| b) For beams supporting floors / masonry | : Span / 325 |
| c) For beams supporting pipes (pipe racks) | : Span / 400 |
| d) For roofing and cladding components | : Span / 250 |
| e) For gratings and chequered plates | : Span / 200 |
| | subject to a maximum of 6 mm |
| f) Coal conveyor gallery bridges | : Span / 450 |

3) **Horizontal deflections**

The permissible horizontal deflections shall be as per following unless specified otherwise:

- | | |
|--|----------------|
| a) Single storey building (without crane load) | : Height / 300 |
| b) Multistoried building (without crane load) | : Height / 500 |
| c) Pipe rack columns | : Height / 200 |
| d) Open Structures | : Height / 200 |

Provisions of IS: 800 and relevant latest IS Codes shall be followed for limiting deflections of structural elements not listed above.

7. MINIMUM THICKNESS AND SIZES OF STEEL ELEMENTS

1) Minimum Thickness

The minimum thickness of various components of a structure and hot rolled sections shall be as follows. The minimum thickness of rolled shapes shall mean flange thickness regardless of web thickness. Structural steel members exposed to significantly corrosive environment shall be increased suitably in thickness or suitably protected otherwise as per good practice and sound engineering judgement in each instance.



- | | |
|--|---------------------|
| a) Trusses, purlins, girts and bracing | : 8 mm |
| b) Columns and beams | : 10 mm |
| c) Gussets | : 10 mm |
| d) Stiffeners | : 10 mm |
| e) Base plates | : 12 mm & above |
| f) Chequered plates | : 10 mm o/p & above |
| g) Grating flats | : 5 mm |
| f) Minimum thickness of structural members other than gratings and chequered plate directly exposed to weather and inaccessible for painting and maintenance shall be 10 mm. | |

2) **Minimum Sizes**

The flange width of purlins supporting light weight concrete slab shall not be less than 75 mm and for those supporting roof sheeting and wall cladding it shall not be less than 50 mm. Width of steel rolled section connected to other member shall be at least 50 mm. The depth of beams for platform of all structures shall not be less than 125 mm.

8. **SLENDERNESS AND DEPTH RATIO**

- 1) The slenderness ratio of main members in tension, compression or bending shall be in accordance with IS:800.
- 2) The following limiting ratios of depth to span shall be considered as a general guide.

a) Truss	1 / 10
b) Rolled beams and girders for Ordinary floors and rafters	1 / 24
c) Supporting floor beams for vibrating Machines / equipments	1 / 15
d) Roof purlins and girts	1 / 45
e) Gable columns	1 / 30

9. **FABRICATION AND ERECTION**

- 1) BIDDER shall prepare detailed fabrication drawings and erection scheme based on the design drawings approved by OWNER/OWNER'S ENGINEER. Fabrication drawings are not to be submitted to OWNER for approval as the responsibility for correct detailing rests exclusively on the BIDDER. BIDDER shall submit one typical fabrication drawing for each type of structure to owner/owner's engineer for review or approval. However, these drawings shall be furnished to OWNER for their reference to effect payment. Fabrication shall commence only on the basis of the fabrication drawings approved by the BIDDER'S Consultant.



- (a) Fabrication shall in general follow the provisions of IS:800, and good engineering practice where provisions of IS:800 are not clear.
- (b) Tolerance in fabricated steel work shall be as per IS: 7215.
- (c) Erection of fabricated steel components shall be as per erection drawings prepared by BIDDER and approved by his CONSULTANT.
- (d) Tolerance for erected steel structures shall be as per IS:12843.

2) Inspection of Welding

The extent of quality control in respect of welds for structural elements shall be as detailed in the technical specifications.

10. PAINTING

"All structural steel components at all elevations shall first undergo surface preparation via abrasive blasting with copper slag to achieve a near-white metal finish (Sa 2½). Following preparation, the steel shall be painted using a four-coat system. The primer system shall consist of two coats of High-Build self-priming epoxy (Composition: Modified epoxy cured with polyamidoamine) applied at 100 microns DFT per coat; the first coat shall be an aluminum shade and the second a light grey shade. This shall be followed by two topcoats of Acrylic Polyurethane paint (Composition: Acrylic resin with urethane hardener, cured with aliphatic isocyanates) applied at a minimum of 30 microns DFT per coat; the third coat overall shall be a dark grey shade and the final (fourth) coat shall be a smoke grey shade." **Total Minimum DFT: 260 microns.** All structure which are required to modify for interfacing or for any other reason has to be also painted as per above specification.

BIDDER shall use the painting system as a reference and Manufacturer's recommendations shall be followed after OWNER approval. All painted structures shall be inspected before dispatch subject to the approval of the OWNER. Only reputed manufacturer of the industrial paint shall be permitted.

- 1) In general Shop fabricated equipment will be delivered to the site coated with a shop applied system or the manufacturer's standard finish in accordance with the requirements of this specification. For equipment that has received shop prime coat, touch-up prime coat and additional coats shall be applied in accordance with the coating schedule. It is responsibility of the vendor to ensure compatibility between shop and field applied paint systems. GIPCL reserves the right to ask contractor for painting of the equipment if it not inline with required painting specification.
- 2) 10.2 Steel surface which is to paint shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be cleaned to grade SA-2 1/2 as per SIS05-5900 or as per IS:1477 (part -I).
- 3) 10.3 Finish paint shall be 2 coats. Dry film thickness of each coat shall be 30 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. All paints shall be of approved brand and shade as per the OWNER's requirement.
- 4) 10.4 Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly, where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.
- 5) 10.5 Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.



11.REQUIREMENTS FOR SPECIFIC STRUCTURES

1) LIGNITE HANDLING SYSTEM STRUCTURES

- a) Toe guards shall be provided on sides of conveyor gallery, toe guard shall have a minimum size of 65 x 6 mm.
- b) In case the inclination of the conveyor is more than 10°, walkway shall be given steps.
- c) For the design of conveyor gallery, load due to cables, light fittings and pipes as well as effect of gravity take up loads shall also be considered, in addition to dead load, wind load and imposed load.
- d) Lattice girders (Mandatorily beam-box type bottom cord along with suitable thickness panel bottom structure) supporting the conveyor shall be suitably braced at top and bottom chord levels to transmit the wind load to the end portals connected to trestles. Roof purlins and walkway runners shall also be suitably braced (preferably box structure) at both ends.
- e) In the case of galleries, temperature expansion joint shall be introduced at intervals less than 180 m to divide the galleries into temperature block. In each block at least one number four-legged rigid support guaranteeing stability of structure in the longitudinal direction shall be provided. This shall also take care of all longitudinal forces in the given block. Effect of wind load shall be considered. The trestle also shall be box type section preferably along with box bracing. The gallery portal and portal bracket, stool shall have adequate thickness member (Stool and portal bottom preferably build-up structure).
- f) Base plates for trestles (Base plate, foundation bolts, and trestle base upto 500mm shall be fabricated with suitable size structural member with adequate thickness) shall be designed as gusseted bases with shear lugs to transfer horizontal forces. Anchor bolts shall be designed only for uplift forces.
- g) Chute loads on floors of houses shall be considered plugged with material for the entire height of the chute.
- h) In case chequered plates are used as floor covering the thickness of plate o/p shall be 10 mm. Suitable plan bracings shall be provided 75 mm from top of steel to transfer all the horizontal forces.
- i) Anchor fasteners shall not be used for supporting equipment imparting dynamic forces.
- j) Bracing patterns and locations shall be so planned such that they do not hinder movement of personnel and movement of equipment during maintenance. When floor beam form part of vertical bracing system, additional loads from the floor beams transferred to the bracing shall be considered.
- k) None of member thickness shall be less than 8mm.
- l) All foundation bolts shall be provided with double nuts with washer.
- m) End connection for rolled beams and channels shall be designed for a minimum of 60% of their shear capacity and built up beams for 80% of their shear capacity in addition to axial load.

- n) Dynamic analysis shall be carried out for beams, rotating equipments and conveyor supporting beam in conveyor gallery.
- o) To admit proper light into the conveyor gallery Perspex sheet shall be provided at the rate of one square meter per meter length of gallery on the roof and 0.2 square meter per meter length of gallery per side on the sides of conveyor gallery.

2) Galvanising

- a) Galvanising of the towers shall be as per IS:4759 and 2633 and as given in the following paras.
- b) Before galvanising, the steel shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or such other foreign matters as are likely to interfere with the galvanising process.
- c) The acceptable values of the coating of zinc on the steel materials shall be in accordance with Table below:

KIND OF MATERIAL	COATING	
	Average value	Minimum value
Structural steel members except bolts,nuts and washers	Over 750 gm/sq.m	610 gm/sq.m
For bolts, nuts and washers	Over 550 gm/sq.m	500 gm/sq.m

- d) The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth, and shall be free from defects like discoloured patches, bare spots, globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.
- e) There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four no. of one-minute successive dips in copper sulphate solution as per IS:2633 unless specified otherwise.
- f) All galvanized members shall be treated with sodium dichromate solution or an approved equivalent after galvanizing, so as to prevent white storage stains.
- g) Galvanizing of each member shall be carried out in one complete immersion. Double dipping shall not be permitted.
- h) Wherever galvanized bolts, nuts, washers, accessories etc are specified, these shall be hot-dip galvanized. Spring washers shall be electro-galvanized. Readily available GI nuts, bolts and washers conforming to galvanizing requirements may also be used.
- i) BIDDER shall ensure that galvanizing is not damaged in transit. In the event of occurrence of any damage, BIDDER shall at his own cost adopt scrapping and reglavanising the member to satisfy the specific requirements.



SUPPLY AND FABRICATION OF STRUCTURAL STEEL

1. SCOPE

- 1) This specification covers the general requirements for supply where specified, fabrication and delivery at site of structural steel.
- 2) This specification also covers design of all connections and substituted members, preparation of all shop fabrication drawings, inspection and shop painting of structures.

2. APPLICABLE CODES & SPECIFICATIONS

The following specifications, standards and codes are made a part of this specification. All standards, specifications and codes of practices referred to herein shall be the latest editions including all applicable official amendments and revisions.

In case of discrepancy between this specification and other documents referred to herein, this specification shall govern.

a) Materials

- i) IS : 808 Dimensions for Hot Rolled Steel sections
- ii) IS : 814 Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon Manganese Steel
- iii) IS : 1161 Steel Tubes for structural purposes
- iv) IS : 1239 Mild steel tubes, tubulars and other Wrought steel fittings
Part 1 - Mild steel tubes
Part 2 - Mild steel Tubulars and other wrought steel pipe fittings
- v) IS : 1363 Hexagon Head Bolts, Screws and Nuts of product
(Parts 1 to 3) Grade C (Size range M5 to M64)
- vi) IS : 1367 Technical Supply Conditions for Threaded Fasteners
(All Parts)
- vii) IS : 1852 Rolling and Cutting Tolerances for Hot Rolled Steel Products
- viii) IS : 1977 Structural Steel (Ordinary Quality)
- xi) IS : 2062 Steel for General Structural Purposes
- x) IS : 2074 Ready Mixed Paint, Air drying, Red Oxide Zinc Chrome and Priming
- xi) IS : 3502 Steel Chequered Plate



- xii) IS : 3757 High Strength Structural Bolts
- xiii) IS : 5369 General Requirements for Plain Washers and Lock Washers
- xiv) IS : 5372 Taper Washers for Channels
- xv) : 5374 Taper Washer for I Beams
- xvi) IS : 6610 Heavy Washers for Steel Structures
- xvii) IS : 8500 Structural Steel-microalloyed (medium and high strength qualities)

b) Codes Of Practice

- i) IS : 800 Code of Practice for General Construction in Steel
- ii) IS : 801 Code of practice for use of Cold formed light gauge steel structural members in general building construction
- iii) IS : 803 Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded storage tanks
- iv) IS : 806 Code of practice for use of steel tubes in general building construction
- v) IS : 816 Code of Practice for use of Metal Arc Welding for General construction in Mild Steel
- vi) IS : 822 Code of Procedure for Inspection of Welds
- vii) IS : 1182 Recommended Practice for Radiographic examination of Fusion - Welded Butt Joints in Steel Plates
- viii) IS : 1200 Method of Measurement in Building Civil Engineering Works
- ix) IS : 1477 Code of Practice for Painting of (Parts 1 & 2) Ferrous Metals in Buildings
- x) IS : 2595 Code of Practice for Radiographic Testing
- xi) IS : 3658 Code of Practice for Liquid Penetrant Flaw Detection
- xii) IS : 4000 High strength bolts in Steel Structures - Code of Practice
- xiii) IS : 5334 Code of Practice for Magnetic Particle Flaw Detection of Welds
- xiv) IS : 7215 Tolerances for Fabrication of Steel Structures
- xv) IS : 9595 Recommendations for Metal Arc Welding of Carbon



and Carbon Manganese Steel

3. STEEL MATERIALS

Steel materials shall comply with the specifications laid down under clause 2.0 and/or as called for on the design drawings.

All materials used shall be new, unused and free from defects.

Steel conforming to IS:1977 shall be used only for the following :

Fe310-0(St 32-0) : for general purposes such as door/ window frames, grills, steel gates, handrails, fence posts, tee bars and other non-structural use.

Fe410-0(St 42-0) : for structures not subjected to dynamic loading other than wind loads such as: Platform roofs, foot over bridges, building, factory sheds etc.

Fe410-0(St 42-0) :Grade steel shall not be used

- a) if welding is to be employed for fabrication.
- b) if site is in severe earthquake zone.
- c) if plastic theory of design is used.

4. DESIGN DRAWINGS PREPARED BY THE BIDDER

- 1) Design drawings shall be prepared by VENDOR/BIDDER and all drawings so prepared shall be furnished to the OWNER /ENGINEER for approval. These design drawings prepared by the CONTRACTOR will show all the, levels, forces on members where shall necessary, size and orientation of each member, location/size of openings. It shall be clearly understood that these drawings are not intended to show connection details, thickness of members, cuts, notches, bends and such other details.
- 2) The OWNER/ENGINEER reserves the right to make changes. Revisions to drawings, even after release for preparation of shop drawings, are very likely to be made to reflect additional data/details received and updated requirements.

5. FABRICATION / ERECTION DRAWINGS PREPARED BY THE VENDOR/BIDDER

- 1) The VENDOR/BIDDER shall prepare all fabrication and erection drawings for the entire work. All the drawings for the entire work shall be prepared in metric units. The drawings shall preferably be of one standard size and the details shown there in shall be clear and legible.
- 2) The VENDOR/BIDDER shall not commence detailing unless design drawings are officially approved for preparation of shop drawings. The VENDOR/BIDDER shall be responsible for the correctness of all fabrication drawings. Fabrication drawings shall be revised by the VENDOR/BIDDER to reflect all revisions in design drawings as and when such revisions are made by the OWNER/ENGINEER.



- 3) All fabrication drawings shall be submitted to the OWNER/ENGINEER for approval/information.
- 4) No fabrication drawings will be accepted for ENGINEER's approval unless checked and approved by the VENDOR/BIDDER's qualified structural engineer and accompanied by an erection plan showing the location of all pieces detailed. The VENDOR/BIDDER shall ensure that connections are detailed to obtain ease in erection of structures and in making field connections.
- 5) Fabrication shall be started by the VENDOR/ BIDDER only after OWNER/ENGINEER's approval of fabrication drawings. Approval by the ENGINEER of any of the drawings shall not relieve the VENDOR/BIDDER from the responsibility for correctness of engineering & design of connections, workmanship, fit of parts, details, material, errors or omissions of any and all work shown thereon.

6. FABRICATION

1) General

All workmanship and finish shall be of the best quality and shall conform to the best approved method of fabrication. All materials shall be finished straight and shall be machined/ground smooth true and square where so specified. All holes and edges shall be free of burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Unless otherwise directed/ approved, reference may be made to relevant IS codes for providing standard fabrication tolerance. Material at the shops shall be kept clean and protected from weather.

2) Connections

- 1) Shop/field connections shall be as per approved fabrication drawings.
- 2) In case of bolted connections, taper washers or flat washers or spring washers shall be used with bolts as necessary. In case of high strength friction grip bolts, hardened washers be used under the nuts or the bolt heads whichever are turned to tighten the bolts. The length of the bolt shall be such that atleast one thread of the bolt projects beyond the nut, except in case of high strength friction grip bolts where this projection shall be atleast three times the pitch of the thread.
- 3) In all cases where bearing is critical, the unthreaded portion of bolt shall bear on the members assembled. A washer of adequate thickness may be provided to exclude the threads from the bearing thickness, if a longer grip bolt has to be used for this purpose.
- 4) All connections and splices shall be designed for full strength of members or loads indicated on design drawings. Column splices shall be designed for the full tensile strength of the minimum cross section at the splice.
- 5) All bolts , nuts, washers, electrodes, screws etc. shall be supplied/brought to site 10% in excess of the requirement in each category and size.
- 6) All members likely to collect rain water shall have drain holes provided.



3) Straightening

All materials, shall be straight and, if necessary, before being worked shall be straightened and/or flattened by pressure and shall be free from twists. Heating or forging shall not be resorted to without the prior approval of the OWNER/ENGINEER in writing.

Cutting, punching, drilling, welding and fabrication tolerances shall be generally as per relevant IS codes.

4) Rolling and Forming

Plates, channels, etc., shall be accurately laid off and rolled or formed to required profile/shape as called for on the drawings. Adjacent sections shall be match-marked to facilitate accurate assembly, welding and erection in the field.

5) High Strength Friction Grip Bolting

Inspection after tightening of bolts shall be carried out as stipulated in the appropriate standards depending upon the method of tightening and the type of bolt used.

6) Welding

- a) Welding procedure shall be submitted to OWNER/ENGINEER for approval. Welding shall be entrusted to only qualified and experienced welders who shall be periodically tested and graded as per IS 817, IS:7310 (Part 1) and IS:7318 (Part 1).
- b) While fabricating plated beams and built up members, all shop splices in each component part shall be made before such component part is welded to other parts of the members. Wherever weld reinforcement interferes with proper fit-up between components to be assembled for welding, these welds shall be ground flush prior to assembly.
- c) Approval of the welding procedure by the OWNER/ENGINEER shall not relieve the BIDDER of his responsibility for correct and sound welding without undue distortion in the finished structure.
- d) No welding shall be done when the surface of the members is wet nor during periods of high wind.
- e) Each layer of a multiple layer weld except root and surfaces runs may be moderately peened with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from overpeening.
- f) No welding shall be done on base metal at a temperature below -5 Deg.C. Base metal shall be preheated to the temperature as per relevant IS codes.
- g) Electrodes other than low-hydrogen electrodes shall not be permitted for thicknesses of 25 mm and above.

Welding test shall be mandatorily carried out based on requirement for structures of the critical structures joint having thickness above 16mm.

7) Inspection of Welds

All welds shall be inspected for flaws by any of the methods described under clause 8 "Inspection". The choice of the method adopted shall be determined by the OWNER/ENGINEER.

The correction of defective welds shall be carried out as directed by the OWNER/ENGINEER without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means as prescribed by



the OWNER/ENGINEER shall be used to ensure that the whole of the crack and material upto 25 mm beyond each end of the crack has been removed.

8) Tolerances

The dimensional and weight tolerances for rolled shapes shall be in accordance with IS:1852 for indigenous steel and equivalent applicable codes for imported steel. The tolerances for fabrication of structural steel shall be as per IS:7215.

9) End Milling

Where compression joints are specified to be designed for bearing, the bearing surfaces shall be milled true and square to ensure proper bearing and alignment.



7. INSPECTION

The VENDOR/BIDDER shall give due notice to the OWNER/ENGINEER in advance of the works getting ready for inspection. All rejected material shall be promptly removed from the shop/site and replaced with new material for the OWNER 's/ENGINEER's approval/ inspection.

No materials shall be painted or despatched to site without inspection and approval by the OWNER / ENGINEER unless such inspection is waived in writing by the OWNER / ENGINEER.

The VENDOR/BIDDER shall provide all the testing and inspection services and facilities for shop work except where otherwise specified.

For fabrication work carried out in the field the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the OWNER / ENGINEER.

1) Inspection and tests on structural steel members shall be as set forth below:

Material Testing

If mill test reports are not available for any steel materials the same shall be got tested by the VENDOR/BIDDER to the OWNER /ENGINEER's satisfaction to demonstrate conformity with the relevant specification.

2) Tests on Welds

a) Magnetic Particle Test

UT test

Where welds are examined by magnetic particle testing, such testing shall be carried out in accordance with relevant IS codes. If heat treatment is performed, the completed weld shall be examined after the heat treatment. All defects shall be repaired and retested. Magnetic particle tests shall be carried out using alternating current. Direct current may be used with the permission of the OWNER/ENGINEER.

b) Liquid Penetrant Inspection

In the case of welds examined by Liquid Penetrant Inspection, such tests shall be carried out in accordance with relevant IS Code. All defects shown shall be repaired and rechecked.

c) Radiographic Inspection

All full strength butt welds shall be radiographed in accordance with the recommended practice for radiographic testing as per relevant IS code.

3) Dimensions, Workmanship & Cleanliness



Members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment, surface finish and painting are in accordance with the requirements shown in the VENDOR/BIDDER's approved design & fabrication drawings.

8. Test Failure

In the event of failure of any member to satisfy inspection or test requirement, the BIDDER shall notify the OWNER/ENGINEER. The VENDOR/BIDDER must obtain permission from the OWNER/ENGINEER before repair is undertaken. The quality control procedures to be followed to ensure satisfactory repair shall be subject to approval by the OWNER/ENGINEER.

- 1) The OWNER/ENGINEER has the right to specify additional testing as he deems necessary.
- 2) The VENDOR/BIDDER shall maintain records of all inspection and testing which shall be made available to the OWNER/ENGINEER.

9. SHOP MATCHING

For other steel work, such as columns along with the tie beams/bracings may have to be shop assembled to ensure satisfactory fabrication, obtaining of adequate bearing areas etc. if so desired by the OWNER/ENGINEER.

10. DRILLING HOLES FOR OTHER WORKS

As a part of this Contract, holes in members required for installing equipment or steel furnished by other manufacturers or other BIDDERS shall be drilled by the VENDOR/BIDDER.

11. MARKING OF MEMBERS

- 1) After checking and inspection, all members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on it. The erection mark shall be stamped with a metal dye with figures at least 20 mm high and to such optimum depth as to be clearly visible.
- 2) All erection marks shall be on the outer surface of all sections and near one end, but clear of bolt holes. The marking shall be so stamped that they are easily discernible when sorting out members. The stamped marking shall be encircled boldly by a distinguishable paint to facilitate easy location.
- 3) Erection marks on like pieces shall be in identical locations. Members having lengths of 7.0 m or more shall have the erection mark at both ends.



12.ERRORS

Any error in shop fabrication which prevents proper assembling and fitting up of parts in the field by moderate use of drift pins or moderate amount of reaming will be classified by the OWNER/ENGINEER as defective workmanship. In case OWNER/ENGINEER rejects such material or defective workmanship, the same shall be replaced by the materials and workmanship conforming to the OWNER/ENGINEER 's requirements by VENDOR/BIDDER.

13.PAINTING

- 1) All fabricated steel material, except those galvanised shall receive protective paint coating as specified in specification elsewhere.
- 2) Galvanising of fabricated steel shall be done as specified in specification.

ERECTION OF STRUCTURAL STEEL

1. SCOPE

This specification covers the general requirements for erection of structural steel. It covers the supply and delivery of all necessary materials, labour, scaffolding, tools, tackles, equipment and everything that is necessary for the satisfactory completion of the job on schedule. Data Sheet A covers the specific requirements for the project. The two parts are complementary and are to be read together for a correct interpretation of the provisions of this specification. Where requirements of the two sections conflict, those of Data Sheet A shall govern.

2. APPLICABLE CODES & SPECIFICATIONS

- ❖ The following specifications, standards and codes are made a part of this specification. All standards, specifications and codes of practice referred to herein shall be the latest editions, including all applicable official amendments and revisions.
- ❖ In case of discrepancy between this specification and other documents referred to herein, this specification shall govern. In case of discrepancy between tender drawings and this specification, the tender drawings shall govern.

3. Structural

- (a) IS:800 Code of Practice for General Construction in Steel



- (b) IS:801 Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members in General Building Construction
- (c) IS:806 Code of Practice for Use of Steel Tubes in General Building Construction
- (d) IS:7205 Safety Code for Erection of Structural Steel Work
- (e) IS:7215 Tolerances for Fabrication of Steel Structures
- (f) IS:4000 High Strength Bolts in Steel Structure - Code of Practice
- (g) AISC Specifications for Design, Fabrication and Erection of Buildings

4. ERECTION SCHEME

Each Bid shall be accompanied by a broad erection scheme with dates and estimated completion time for various parts of the work prepared by BIDDER after a thorough study of the site conditions. This erection scheme shall describe the methods proposed to be employed by BIDDER for transporting his equipments, tools, tackles, gas cylinders, electrodes and all that is necessary to site, unloading, transporting within the site, handling, assembling, hoisting and erecting of the structural steel components and the type, capacity and quantity of equipment that BIDDER proposes to bring to site for all these operations. The scheme shall also indicate the strength and trade wise composition of the work force and supervisory personnel that will be deployed by BIDDER for the various operations.

5. ERECTION PROGRAMME

- ❖ The successful BIDDER shall submit, a detailed erection programme. This programme shall be accompanied by a layout plan identifying the areas proposed for unloading, main storage, subsidiary storage, assembly and the transportation of equipment and fabricated material between the storage and work areas. The layout shall clearly indicate the points at which proposed erection begins, direction in which it is proposed to progress, the deployment of equipment, access route for cranes to reach work areas, etc. The locations and extent of site offices and stores, labour quarters if any, layout of electrical cables and water pipes from the tap-off points shall also be indicated in detail on the above layout. Full details of the method of handling, transport, hoisting and erection including false work/staging, temporary bracing, guying, etc. shall be furnished by BIDDER in this erection programme along with complete details of the quantity and capacity of the various items of erection equipment that will be used. A site organization chart showing the number of supervisory personnel, and the number and composition of the various gangs shall also accompany the erection programme.
- ❖ Any modifications to the erection programme directed by OWNER/ENGINEER for the reasons of inadequacy of the quantity and/or capacity of the erection equipment, erection personnel and supervisors, temporary bracing, guying etc., or safety of the erection methods, or stability of the erected portions of structures, or unsuitability of the erection sequence due to interference with the work of other agencies shall be incorporated by



BIDDER and the work shall be carried out in accordance with the revised programme. Approval by OWNER/ENGINEER shall not relieve BIDDER from the responsibility for the safe, sound, accurate and timely erection of structural steel work as required by ENGINEER/OWNER to site for erection, if so directed by ENGINEER. BIDDER shall be deemed to have visualized all erection problems while bidding for the work and no additional compensation shall be claimed on this account.

6. SITE OPERATIONS

- ❖ An experienced and qualified Superintendent shall be in full time charge of the job.
- ❖ BIDDER shall complete all preliminary works at site well before the arrival of structural steel, such as establishment of a well-equipped and adequately staffed site office, stores, unloading gantry, unloading and pre-assembly yard, labour quarters if any, electrical and water connections, electrical winches, derricks, cranes, compressors, all tools and tackles, rivet guns, welding sets, torque wrenches, spud wrenches, staging, etc. as well as experienced erection and supervisory personnel as part of this contract and any other work that may be necessary so as to start erection immediately after the arrival of the first batch of steel at site.
- ❖ BIDDER shall furnish at his own expense, the necessary non-inflammable staging and hoisting materials or equipment required for the erection work and shall remove and take them away after completion of the job. BIDDER shall also provide necessary passageways, fences, safety belts, helmets, lights and other fittings to the satisfaction of OWNER/ENGINEER and to meet the rules of local authorities and for protection to his men and materials. A licensed electrician shall be kept on the job for the entire duration of the work to maintain BIDDER's electrical equipment and connections.
- ❖ BIDDER shall protect all existing plant, structures, piping, conduits, equipment and facilities against damage during erection. Any damage caused by BIDDER shall be rectified entirely at BIDDER's cost, to the satisfaction of OWNER/ENGINEER. If work has to be carried out adjacent to existing switch yards or electrical installations which are live, BIDDER must ensure suitable safety precautions in consultation with OWNER/ENGINEER.

7. ACCEPTANCE OF STEEL, ITS HANDLING & STORAGE

- ❖ Point of delivery of fabricated steel shall be as specified.
- ❖ BIDDER shall carefully check the steel to be erected at the time of acceptance. Any fabrication defects observed should be brought to the notice of OWNER/ ENGINEER.



- ❖ No dragging of steel shall be permitted. All steel shall be stored 300mm above ground on suitable packing to avoid damage. It shall be stored in the order required for erection, with erection marks visible. All storage areas shall be prepared and maintained by BIDDER. Steel shall not be stored in the vicinity of areas where excavation or grading will be done and, if so stored temporarily, this shall be removed by BIDDER well before such excavation and/or grading commences to a safe distance to avoid burial under debris.
- ❖ Scratched or abraded steel shall be given a coat of primer specified under Data Sheet A for protection after unloading and handling prior to erection. All milled and machined surfaces shall be properly protected from rust/corrosion by suitable coating and also from getting damaged.

8. ANCHOR BOLTS & FOUNDATIONS

- ❖ BIDDER shall carefully check the location and layout of anchor bolts embedded in foundations constructed, to ensure that the structures can be properly erected as shown on the drawings, Any discrepancy in the anchor bolts/foundation shall be reported to OWNER/ENGINEER.
- ❖ Levelling of column bases to the required elevation may be done either by providing shims or three nuts on the upper threaded portion of the anchor bolt. All shim stock required for keeping the specified thickness of grout and in connection with erection of structures on foundations, crane brackets or at any other locations shall be of good M.S. plates and shall be supplied by BIDDER at his cost.
- ❖ Where beams bear in pockets or on walls, bearing plates shall be set and levelled as part of the work. All grouting under column base plates or beam bearing plates will be carried out by BIDDER.

9. ASSEMBLY & CONNECTIONS

- ❖ Field connections may be effected either by riveting, bolting, welding or by use of high strength friction grip bolts as specified in Data Sheet-A and as shown on the design and erection drawings.
- ❖ All field connection work shall be carried out in accordance with enclosed Data Sheet - A. All bolts, nuts, washers, rivets, electrodes required for field connections shall be supplied by Erector free of cost.
- ❖ All assembling shall be carried on a level platform.
- ❖ Drifts shall be used only for drawing the work to proper position and must not be used to such an extent as to damage the holes. Size of drifts larger than the nominal diameter of hole shall not be used. Any damaged holes or burrs must be rectified to the satisfaction of



OWNER/ENGINEER.

- ❖ Corrections of minor misfits and reasonable amount of reaming and cutting of excess stock from rivets shall be considered as a part of erection. Any error in the shop, which prevents proper fit on a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to OWNER/ENGINEER.

10. ERECTION

- ❖ All structural steel shall be erected as shown on the drawings. Proper size steel cable slings, etc., shall be used for hoisting. Guys shall not be anchored to existing structures, foundations, etc. unless so permitted by OWNER/ENGINEER in writing. Care shall be taken to see that ropes in use are always in good condition.

All high rise and critical structures shall be tested for their verticality/deflection etc with respective tools like total station/theodolite/deflection sticker marked in structures. Erected members shall be provided Guys rope accordingly for stability. In case of deflection/bends, the same shall be attached to structures for straightness and shall be release once permissible straightness achieved. Welding of the structure to be done immediately after finding of the desire's straightness of the columns. All temporary bolts, platforms to be removed after erection of the structure & testing of the of the structures. Erection bolts/cleats/ holder shall be provided in advance before lifting of the structures. Load analysis, land compaction, load charts of the machine shall be verified before lifting of the structures.

- ❖ Steel columns in the basement, if any, are to be lowered and erected carefully with the help of a crane and/or derrick without damaging the basement walls steel or floor.
- ❖ Structural steel frames shall be erected plumb and true. Frames shall be lifted at such points that they are not liable to buckle and deform. Trusses shall be lifted only at node points. In the case of trusses, roof girders, all of the purlins and wind bracing shall be placed simultaneously and the columns shall be erected truly plumb on screed bars over the pedestals. All steel columns and beams shall be checked for plumb and level individually before and after connections are made. Temporary bracings shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment and the operation thereof. Such bracings shall be left in place as long as may be required for safety and stability.
- ❖ Chequered plates shall be fixed to supporting members by tack welding or by countersunk bolts as shown/specified in relevant drawings and/or as directed by OWNER/ENGINEER. The edges shall be made smooth and no burrs or jagged ends shall be left. While splicing, care should be taken so that there is continuity in pattern between the two portions. Care should also be taken to avoid distortion of the plate while welding. The erection of chequered plates shall include :
 - Welding of stiffening angles/vertical stiffening ribs
 - Cutting to size and making holes to required shape wherever necessary to allow service piping and/or cables to pass through

- All erection machinery and manpower shall have to comply as per statutory norms.

mm or ± 15 mm whichever is less

12..4. Deviation in straightness in longitudinal : $\pm 1/1000$ of column height
 in and transverse planes of column at any : mm or ± 10 mm whichever
 point along the height is less

12..5. Difference in erected position of adjacent : ± 10 mm
 pairs of columns along length or across
 width of building prior to connecting
 trusses/beams with respect to true distance

12..6. Deviation in any bearing or seating level : ± 5 mm
 with respect to true level

12..7. Deviation in differences in bearing levels : ± 10 mm
 of a member on adjacent pair of columns
 both across and along the building

❖ Trusses And Beams

12..1. Shift at the center of span of top chord : $\pm 1/250$ of height of truss in
 12..2. member with respect to the vertical plane mm or ± 15 mm whichever passing
 through the center of bottom chord is less

12..3. Lateral shift of top chord of truss at the : $\pm 1/1500$ of span of truss in center of
 span from the vertical plane mm or ± 15 mm whichever passing through the
 center of supports is less
 of the truss

12..4. Lateral shift in location of truss from its : ± 10 mm true vertical position

12..5. Lateral shift in location of purlin true position : ± 5 mm

12..6. Deviation in difference of bearing : i) ± 20 mm
 for trusses levels of trusses or beams from ii) For beams
 the true difference Depth < 1800mm : ± 6 mm
 Depth > 1800mm : ± 10 mm

12..7. in sag in chords and diagonals : $1/1500$ of length in mm or
 of truss between node points 10mm whichever is smaller

12..8. Deviation in sweep of trusses, beams etc
 in the horizontal plane: $1/1000$ of span in mm Subject to a maximum

of 10 mm

13. CLEAN UP OF WORK SITE

- ❖ During erection, the BIDDER shall, at all times keep the working and storage areas used by him, free from accumulation of waste materials or rubbish. Before completion of erection, he shall remove or dispose of in a satisfactory manner all temporary structures, waste and debris and leave the premises in a condition satisfactory to OWNER/ENGINEER.

ERECTION OF STRUCTURAL STEEL-DATA SHEET-A

SL.	DESCRIPTION	ALTERNATIVE
1.	DELIVERY OF FABRICATED STEEL (REFER CLAUSE 6.1)	AT SITE / RAILWAY SIDING LOCATED AT----- / OWNERS STORE LOCATED AT----- ----- / FABRICATOR WORKSHOP LOCATED AT----- /DELIVERED TO TRANSPORT BIDDER AT -----
2.	PAINTING OF SCRATCHED OR ABRADED STEEL WITH PRIMER COAT FOR PROTECTION AFTER UNLOADING AND HANDLING PRIOR TO ERECTION (REFER Respective section)	REFER PAINTING PROCEDURE.
3.	TYPE OF FIELD CONNECTIONS (REFER CLAUSE 8.1)	. REVETTING . BOLTING WITH . M.S.BOLTS TO CLASS 4.6 . H.T.BOLTS TO CLASS 6.6/8.8/10.9 /12.9 . H.S.F.G.BOLTS TO CLASS 8 G/10 K . H.S.F.G.BOLTS TO CLASS ASTM 325/ 490 . WELDING

1. LOADS

IS: 875 Code of Practice for design loads (other than earthquake) for Buildings and structure (All parts)

IS: 1911 Schedule of unit weights of building materials

IS: 1893 Criteria for earthquake resistant design of structure

IS: 15498 Guidelines for improving the Cyclonic Resistance of low rise houses and other buildings/ structures.

2. FOUNDATIONS

IS: 1080 Code of Practice for design and construction of shallow foundations on soils (other than raft, ring and shell)

IS: 1904 Code of Practice for design and construction of foundations in soils general requirement

IS: 2911 Code of Practice for design and construction of pile foundations: (All parts)

IS: 2950 Code of Practice for design and construction of raft foundations

IS: 2974 Code of Practice for design and construction of machine foundations (all parts)

IS: 4091 Code of Practice for design and construction of foundations for transmission line towers and poles.

IS: 8009 Code of Practice for calculation of settlement of foundations: (All parts)

IS: 9556 Code of Practice for design and construction of diaphragm walls

IS: 11089 Code of Practice for design and construction of ring foundation

IS: 13301 Guidelines for vibration isolation for machine foundations

3. STRUCTURAL STEEL

IS: 800 General construction in steel- Code of Practice

IS: 802 Code of Practice for use of structural steel in overhead transmission line towers: (All parts)

IS: 806 Code of Practice for use of steel tubes in general building construction

IS: 808 Dimensions for hot rolled steel beam, column channel and angle section

IS: 813 Scheme of symbols for welding



IS 814	Covered electrodes for manual metal arc
IS: 816	Code of Practice for use of metal arc welding for general construction in mild steel
IS: 1024	Code of Practice for use of welding in bridges and structures subjected to dynamic loading
IS: 1161	Steel tubes for structural purposes
IS1599	Method of Bend Test.
IS 1608	Method of Tensile Testing of Steel Products.
IS: 2062	Structural steel (fusion welding quality)
IS: 4000	High Strength bolts in steel structures – Code of Practice
IS: 7215	Tolerances for fabrication of steel structures
IS: 8640	Recommendations for dimensional parameters for industrial building
IS: 9178	Criteria for design of steel bins for storage of bulk material (All parts)
IS: 9595	Recommendation for Metal arc welding of carbon and carbon manganese steel
IS: 12843	Tolerances for erection of steel structures

4. MISCELLANEOUS

IS: 1038	Specification for steel doors, windows and ventilators
IS: 1172	Code of basic requirements for water supply, drainage and sanitation
IS: 1346	Code of Practice for water proofing of roofs with bitumen felts
IS: 1742	Code of Practice for building drainage
IS: 1905	Code of Practice for structural use of unreinforced masonry
IS: 2210	Criteria for design of reinforced concrete shell structures and folded plates
IS:2470	Code of Practice for installation of septic tank:
(part 1)	Design criteria and construction
(part 2)	Secondary treatment and disposal of septic tank effluent



IS: 3067	Code of Practice for general design details and preparatory works for damp proofing and water proofing of buildings
IS: 10440	Code of Practice for construction of reinforced brick and reinforced brick concrete floors and roofs
SP: 6	Handbook for structural engineers (all parts)
SP: 7	National Building Code of India
SP: 16	Design Aids for reinforced concrete to IS: 456-2000
SP: 20	Handbook on masonry design and construction
SP: 22	Explanatory handbook on codes for earthquake engineering (IS: 1982-2015 and IS: 4326-2013)
SP: 24	Explanatory handbook on Indian Standard code of Practice for plain and reinforced concrete
SP: 25	Handbook on causes and prevention of cracks in buildings
SP: 32	Handbook on functional requirements of industrial buildings
SP: 34	Handbook of concrete reinforcement and detailing (SCIP)
IRC: 37	Guidelines for design of flexible pavements
IS 383	Specification for coarse & fine aggregates from natural sources for concrete.
IS 3182	Specification for broken brick (burnt clay) fine aggregate for use in lime mortar.
IS 6925	Method of test for determination of Water Soluble Chlorides in concrete admixtures.
IS 5624	Foundation bolts.
IS1363 (Part I to 3)	Hexagon Head bolts, screws, nuts.
IS 2016	Plain washers.
IS 2614	Method for sampling of fasteners.
IS 1077	Specification for common burnt clay building bricks.
IS3495 (Part I to 4)	Method of Test for burnt clay building bricks.

IS 3620	Specification for Rubble stone block for masonry.
IS 1121	Method of test for determination of strength properties of natural building stone.
IS 1125	Method of test for determination of weathering of natural building stones.
IS 1126	Method of test for determination of durability of building stone.
IS 1127	Recommendation for dimensions and workmanship of natural building stones for masonry work.
IS 460 (Part I to 3)	Specification for Test Sieves.
IS 1129	Recommendation for dressing of natural building stone.
IS 1130	Specification for Marble (blocks, slabs and tiles).
IS1008 (Part-2)	Specification for timber panelled & glazed shutters, windows and ventilator shutters.
IS 6315	Specification for floor springs (hydraulically regulated) for heavy doors.
IS 3828	Specification for ventilator chains.
IS 1917	Structural steel (ordinary quality).
IS 1148	Specification for hot rolled rivet bars for structural purposes.
IS 101 (Part I to 8)	Method of sampling and test for paints, Varnishes and related products.
IS 73	Paving Bitumen.
IS 217	Cut Back Bitumen.
IS 454	Specification for cutback bitumen.
IS 5467	Specification for shellac Wax
IS 3037	Specification for Bitumen mastic for use in water proofing of roofs.
IS 782	Specification for caulking lead.
IS405 (Part 1&2)	Lead sheet and strips.
IS 5134	Bitumen impregnated paper.

IS 2849	Specification for non load bearing gypsum partition blocks.
IS 2095	Specification for gypsum plaster boards.
IS 77	Specification for linseed oil, boiled for paints.
IS 533	Gum Spirit of turpentine (oil of Turpentine).
IS 8273	Specification for gypsum plaster for use in the manufacture of fibrous plaster board.
IS5871 1987	- Specification for bitumen mastic for tanking and damp proofing.
IS651 1992	- Specification for salt glazed stoneware pipe and fittings.
IS1729 1979	- Sand cast iron spigot and socket soil pipe.
IS 1230	Cast iron rain water pipes and fittings.
IS 774	Flushing cisterns for water closets and urinals.
IS2548 (Part 1&2)	Specification for plastic seats and cover for water closet.
IS 1726	Specification for cast iron manhole cover and frames.
IS 4984	Specification for high density polyethylene pipes for potable water supplies Sewage and industrial effluents.
IS 7328	High density polyethylene materials.
IS 3076	specification for low density polyethylene pipe for potable water supplies.
IS 9762	Specification for polyethylene floats for ball valve.
IS 3395	Code of practice for fire safety of industrial buildings.
IS7834 (Part I to 8)	Specification for injection moulded PVC fittings with solvent cement joint for water supplies.
IS8008 (Part I to 7)	Specification for injection moulded HDPE fittings for potable water supplies.
IS8360 (Part 1 to 3)	Specification for fabricated high density polyethylene fittings for potable water.
IS 784	Specification for prestressed concrete pipe

IS 1703	Specification for copper alloy float valves (horizontal plunger type) for water supply fittings.
IS 12234	Specification for plastic equilibrium float valve for old water services.
IS 1536	Centrifugally cast (spun) iron pressure pipes.
IS 1537	Vertically cast iron pressure pipes for water, gas and sewage.
IS1538 (Part I to 23)	sand cast iron spigot and socket soil, waste and ventilating pipes fittings and accessories.
IS 3589	Electrically welded steel pipes for water, gas and sewage.
IS 781	Specification for cast copper alloy screw down bib taps and stop valves for water services.
IS 1795	Specification for pillar taps for water supply purposes.
IS 2016	Plain washers.
IRC 19	Standard specification and code of practice for water Bound macadam.
IRC 29	Tentative specification for 4 cm Asphaltic concrete surface course.
IRC 15	Standard specification and code of practice for construction of concrete roads.
IS 1054	Dieldrin emulsifiable concentrates.
IS 1308	Aldrin dusting powders.
IS 6439	Hepta chlor emulsifiable concentrates.
IS 2632	Crotonaldehyde.
IS 1343	Code of practice for prestressed concrete.
IS1785 (Part 1&2)	Specification for plane hard drawn steel wires for prestressed concrete.
IS 1635	Code of practice for field slaking of building lime.
IS 737	Wrought aluminium and aluminium alloys, sheet and strips (for general engineering purposes)
IS 3316	Specification for structural granite.

IS 1196	Code of practice for laying bitumen mastic flooring.
IS 1195	Specification for bitumen mastic for flooring.
IS 1198	Code of practice for laying fixing and maintenance of linoleum floor.
IS7634 (Part I to 3)	Code of practice for plastic pipes.
IS .3114	Code of practice for laying of cast iron pipes.
IRC-SPII	Hand book of quality control for construction of roads and runways.
IRC-63	Tentative guidelines for use of low grade aggregates and soil aggregate mixtures in road pavement construction.
IRC-60	Tentative guidelines for use of Lime Fly Ash Concrete as pavement base or sub-base.
IRC-74	Tentative guidelines for use of Lean Cement Concrete and lean concrete Fly Ash Concrete as pavement base or sub-base.
IS 6509	Code of practice for installation of joints in concrete pavement.
IRC-43	Recommended practice for Tools, Equipment and appliances for concrete pavement construction.
IRC-15	Standard specifications and code of practice for construction of concrete road.
IS 1609	Code of practice for laying damp proofing treatment using bitumen felt.
IS 4365	Code of practice for application of bitumen mastic for waterproofing of roofs.
IS 278	specification for Galvanized barbed wire for fencing.
IS 2721	Specification for Galvanized steel chain link fabric.
IS 4826	Specification for hot dipped galvanized coating on round steel wires.
IS 5916	specification for cast iron gratings for drainage purposes.
IS 4130	Safety Code for demolition of building.
IS 5121	Safety code for piling.
IS 7293	Safety code for working with construction machinery.



IS 7205	Safety code for erection of structural steel works.
IS 9918	Code of practice for in-situ water proofing and damp proofing treatments with glass fibre tissues reinforced bitumen.
BS:4485	Structural design of Cooling Towers (part 4).
AWWA-C - 210	Liquid-Epoxy coatings and lining for steel water pipe and fittings.