**DATE –NOV,2016 (REVISED & MODIFIED)**

**CIVIL /STRUTURAL CONSTRUCTION**

**Quality and Safety Concerns in Construction-**

* Quality control and safety represent increasingly important concerns for project managers. Defects or failures in constructed facilities can result in very large costs. Even with minor defects, re-construction may be required and facility operations impaired. Increased costs and delays are the result. In the worst case, failures may cause personal injuries or fatalities. Accidents during the construction process can similarly result in personal injuries and large costs. Indirect costs of insurance, inspection and regulation are increasing rapidly due to these increased direct costs. Good project managers try to ensure that the job is done right the first time and that no major accidents occur on the project.
* As with cost control, the most important decisions regarding the quality of a completed facility are made during the different stages of construction with the attention to conformance as the measure of quality of construction process, the specification of quality requirements in the design and contract documentation becomes extremely important. Quality requirements should be clear and verifiable, so that all parties in the project can understand the requirements for conformance.
* While the multitude of participants involved in the construction process requires the stage wise inspection, it cannot be emphasized too strongly that inspection are only a formal check on quality control. Quality control should be a primary objective for all the members of a project team. Managers should take responsibility for maintaining and improving quality control. Employee participation in quality control should be sought, including the introduction of new ideas. Most important of all, quality improvement can serve as a catalyst for improved productivity. By suggesting new work methods, by avoiding rework, and by avoiding long term problems, good quality control can pay for itself.
* Safety during the construction project is also influenced in large part by decisions made during the planning and design process.  Beyond these design decisions, safety largely depends upon education, vigilance and cooperation during the construction process. Workers should be constantly alert to the possibilities of accidents and avoid taken unnecessary risks.

**TABLE OF CONTENT**

**1.0 MATERIAL RECEIVING, HANDLING AND STORING**

1.1 General

1.2 Material entry

1.3 Material unloading/handling and storing

**2.0 CIVIL FOUNDATION /BUILDING**

2.1 General

2.2 Materials Unloading and Temporary Storage

2.3 Earthwork

2.4 Masonry Work

2.5 Cement Concrete

2.6 Form work

2.7 Backfilling of Murrum

2.8 Rubble Soling

2.9 Curing

**3.0 STRUCTURAL FABRICATION AND ERECTION**

3.1 General

3.2 Materials Unloading and Temporary Storage

3.3 Fabrication

3.4 Welding

3.5 Erection

3.6 Bracing, Bolting, Alignment

3.7 Final Painting

**4.0 PAINTING**

4.1 General

4.2 Procedure

4.3 Inspection and testing

**5.0 ROOFING WORK**

5.1 General

5.2 Metal Sheeting

5.3Temporary Monsoon Shed

**6.0 CODES AND STANDARDS**

**7.0 QUALITY CONTROL**

1.0 MATERIALS RECEIVING, HANDLING AND STORING –

1.1 General

* Employee should know all specific details about various project materials before any material enter inside factory premises, moving, handling and storing of various locations.

1.2 Material entry/Receiving

* At the time of any type of material entering inside factory at first store supervisor/construction manager has to check material purchase order against material delivery challan and actual material supplied quantity by appropriate vendor.
* Secondly material identification to be checked as well as check whether any damage is thereon material/equipment or any painting damage available on equipment if any damage found out immediately report to concern supplier/vendor.

1.3 Material unloading/handling/storage

* Before material unloading store supervisor has to discuss with construction manager for whether material has to unload/erect on position at site or at store premises.
* At the time of unloading first check the equipment lifting lugs locations as well as crane/hydra/ceilings/belts capacity with updated certification. Same category and different sizes material has to store separate with different colour code or permanent identification for easily identify the material. Material always store at safe place and at dry condition with proper spacing to avoid clashing with each other.

**2.0 CIVIL FOUNDATION /BUILDING**

**2.1 General**

* A **foundation** (or, more commonly, **foundations**) is the element of an [architectural structure](https://en.wikipedia.org/wiki/Architectural_structure) which connects it to the ground, and transfers [loads](https://en.wikipedia.org/wiki/Force) from the structure to the ground. Foundations are generally considered either [shallow](https://en.wikipedia.org/wiki/Shallow_foundation) or [deep](https://en.wikipedia.org/wiki/Deep_foundation).[[1]](https://en.wikipedia.org/wiki/Foundation_(engineering)#cite_note-1) Foundation engineering is the application of [soil mechanics](https://en.wikipedia.org/wiki/Soil_mechanics) and [rock mechanics](https://en.wikipedia.org/wiki/Rock_mechanics) ([Geotechnical engineering](https://en.wikipedia.org/wiki/Geotechnical_engineering)) in the design of foundation elements of structures.

**2.2 Materials Unloading and Temporary Storage**

* This involves physical control of materials, preservation of stores, minimization of obsolescence and damage through timely disposal and efficient handling, maintenance of stores records, proper location and stocking. Stores are also responsible for the physical verification of stocks and reconciling them with book figures. The inventory control covers aspects such as setting inventory levels, ABC analysis, fixing economical ordering quantities, setting safety stock levels, lead time analysis and reporting.

**2.3 Earthwork**

**Scope:**

* The Specification covers the general requirements of earthworks in excavation in different materials, filling in areas as shown in drawing, filling back around foundations and plinths, transportation and or disposal of surplus spoils or stocking them properly as shown on the drawing and as directed by engineers and all others operations covered within the intent and purpose of this specification.

**Responsibility:**

HOD Civil is responsible for maintaining and updating this work instruction.

**Procedure:**

* Barricading shall be provided to work area to restrict man moment.
* Work to permit for exaction to be taken from concern department.
* Excavator checking to be done at Security Gate as per standard checklist.
* Marking for identification of electric cables, chemical lines & water lines will be done by civil department with the help of concern dept.
* Above marking & drawing to be shown to Excavator operator to understand.
* Civil department representative will be available throughout the work for giving guidelines & noting observations of the work.
* After excavation work completion, re-barricading will be provided to excavated area along with sign boards marking NO ENTRY.
* Work permit to be closed & submitted to EHS department.
* Mode of measurement as per IS:1200.

**Environment Requirement:**

In case of leakage during excavation work, transfer leaked material to nearest fat trap.

**Safety Requirement:**

While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area. .

**2.4 Masonry Work**

**Scope :**

* The work under this section consists of providing and constructing all clay brick masonry true to lines & levels as shown on the drawing and as specified
* Brick work Bond shall be as per specified. Half or cut bricks shall not be used except where needed to complete the bond.
* All bonding, level, plumb, course perfection etc. to be check as per the IS standard.
* The brick work shall not be raised more than 14 courses per day.
* All uneven, irregular and disturbed brick work shall be pulled down and rebuilt with fresh bricks at the contractor’s expenses.
* The faces of the wall shall be strictly straight. The masonry shall be shaded from the sun. And kept wet for not less than 7 days after completion.
* All fixtures plugs, frames shall be placed securely as the work proceeds and not after completion of masonry

**Responsibility:**

HOD Civil is responsible for maintaining and updating this work instruction.

**Procedure:**

|  |
| --- |
| Check for through cleaning of surface where masonry to be done. |
| Barricade all openings and cutouts in floor slabs for safety. |
| Mark reference lines on pillars for floor finishes. |
| Check quality of bricks/blocks/stones for water absorption, efflorescence, dimensions & Strength |
| Check for soaking of bricks/blocks as specified. |
| Check proportion of cement mortar with proper platform |
| Check for joining if old work to new in such a way that no hump or projection is visible. |
| Check diagonals & dimensions after laying one course. |
| Check one layer with beam top / bottom edge, plumb etc, for offsets(if any) |
| Openings to be provided for doors at 1st layer |
| Check thickness of joints as specified. |
| Check for chases not more than one third of wall thickness, no horizontal without approval. |
| Raking of joints to a depth of 15mm and brushed while mortar is green. |
| 75mm RC bond at every 1.0 m height in half brick wall. |
| Check level of block works for platforms, lofts, lintels etc. |
| Do not construct more than 5 courses of blocks in a day. |
| Check wetting of existing work before starting next course and curing for new work minimum 7 days. |
| Pack top course with concrete below beams. |
| Check and use tray for mortar mixing. |
| Check complete cleaning of floors after work is complete. |

**Environment Requirement:**

Collecting of unwanted scrap like small brick, small wooden, wasted cement for shifting / storage to identified area.

**Safety Requirement:**

While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area

**2.5 Cement Concrete**

**Scope:**

* This Specification establishes the materials, mixing, placing, curing etc. of all types of cast-in-situ concrete to be used in foundation, underground and above ground structures, floors etc. any special requirement as shown or noted on the drawing shall govern over the provisions of the specifications. All work should be carried out with proper scientific knowledge and practice and it is obligatory that the contractor shall employ a qualified and competent Engineer for the said purpose
* The Specification shall also apply to the extent it has been referred to or applicable with special requirement covered in scope of IS: 456

**Responsibility :**

HOD Civil is responsible for maintaining and updating this work instruction.

**Procedure:**

|  |
| --- |
| Check datum level |
| Check grid lines |
| Check center lines |
| Records Name of structure |
| Records Grade of concrete mix |
| Check vibrates |
| Check needle |
| Check hoist |
| Check dewatering pump |
| Check Shuttering (alignment / level / rigidity) |
| Check Reinforcement (lap, chair, spaces) |
| Check Admixtures ( make / dosage) for RMC |
| Check Insert / anchor bolt / sleeves / cup outs. |
| Check cover blocks |
| Check conduits |
| Check Lighting arrangements |
| Check deviation from drawing (if any) |
| Check provision of construction / expansion joints / water bar on joints |
| Check for reinforcement steel as per drawings before concreting. |
| Check for dowel rods |
| Records Actual starting time |
| Records Actual ending time |
| Check slump (minimum 4 no shown in remarks) |
| Check Water/Cement ratio |
| cubes taken according to concrete quantity |
| Calculate Approximate required quantity of concrete |
| Actual consumption of concrete (as per Challan/ weights) |
| Check & write no. of engineers / their names. |

**Environment Requirement:**

In case of leakage during Concrete work, transfer leaked material to nearest fat trap / identified area.

**Safety Requirement:**

While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area.

**Quality Control:**

* Contractor shall exert proper quality control at various stages of concrete production and placement.
* As frequently as Engineer may require, testing shall be carried out in the field for

1. Moisture content of sand
2. Moisture content of aggregates
3. Silt content of sand
4. Grading of sand

* The Contractor shall provide and maintain all items until the works are completed, equipment and staff required for carrying out these tests. The contractor shall grant the Engineer or his representative full access to this laboratory at all times and shall produce on demand complete records of all tests carried out at site. Alternatively, the contractor may also avail of the services of the local testing laboratory with prior approval of the Engineer.

**Testing of Concrete:**

* 1, 2, 3 and 4 no. of samples for quality of concrete poured daily not exceeding 5Cum, 6-15CUM, 16-30Cum & 31-51CUM respectively shall be taken or as directed by Engineer. From each sample six test cubes shall be made of 150 x 150 x 150mm of size three for testing at seven days and three for testing at twenty eight day. The strength at seven days for use of normal Portland cement shall not be less than two thirds of twenty eight days strength. All tests shall be carried out as per IS: 456, IS: 516 . The results in any recognized laboratory shall be final and binding on the contractor.
* All arrangement for testing concrete cubes shall be made by the contractor at his own cost. All the materials and Labour for making, cutting and transporting the cubes for carrying out necessary tests including the fees of testing whether at site or elsewhere shall be at the cost of the contractor.
* Normally cube strengths substantially in execs of those specified are expected.
* In case of compressive strength obtained from the test cubes of concrete is less than the minimum specified in acceptance Criteria as per IS: 466 – clause 15 the work is liable to be rejected.
* If however, the strength are higher than specified due to good control or otherwise, the contractor, the contractor shall have no claim for extra payment.

**2.6 Form work**

**Scope:**

* Formwork for concrete shall be of plywood, steel, good seasoned timber of other approved materials, properly designed easy to remove and clean and shall give smooth and even surface after removal.
* It should be sufficiently tight to prevent loss of cement slurry from the concrete.

**Responsibility:**

HOD Civil is responsible for maintaining and updating this work instruction.

**Procedure:**

|  |
| --- |
| Check the STRUCTURE-SPECIFIC SHUTTERING SCHEME available? |
| Check the shuttering scheme verified for SUITABILITY & SAFETY? |
| Are SKETCHS showing the approved shuttering scheme available for reference? |
| Check for PHYSICAL CONDITION of scaffolds and shutters. |
| Are damaged and defective elements removed? |
| Check for CLEANLINESS for forms. |
| Check for application of MOULD RELEASING AGENT. |
| Check for Assembly of scaffolds and shutters w.r.t. SHUTTERING SCHEME. |
| Check for provision and Arrangement of the following: Ref: shuttering scheme. |
| 1. H-FRAMES |
| 1. PROPS |
| 1. ADJUSTABLE SPANS |
| 1. BRACINGS |
| 1. CLAMPS & COUPLERS |
| 1. CHANNELS |
| 1. CLIPS |
| 1. PIPES |
| Check for provision and arrangement of: Ref: shuttering scheme. |
| 1. WALL FORM PANELS |
| 1. CORNER ANGLES |
| 1. PLYWOOD OR TIMBER FORMS |
| Check for RIGIDITY of assembled forms. |
| Check for CONFORMANCE of the Assembled forms to DIMENSIONS. |
| SHAPES, LINES & GRADES as shown on the drawings.   |  | | --- | | Check for READINESS of shutter forms for RELEASE to fix Reinforcement. | | Check line and level. | | Confirm that side supports for verticals are sufficient. |   **Environment Requirement:**  During work generated Wooden Scrap, MS scrap transfer to identified scrap yard.  **Safety Requirement:**  While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area. . |
| **2.7 Backfilling of Murrum**  **Responsibility :**  HOD Civil is responsible for maintaining and updating this work instruction.  **Procedure :**   * Backfilling Shall Be Done in Layers of 150mm. Optimum watering shall be done to obtain maximum compaction and density. Compaction shall be done with mechanical equipment such as plate vibrators, rollers. In exceptional cases hand compaction may be restored to as directed by Engineers. * The Engineer reserves the right to order compaction test in initial stages to satisfy degree of compaction up to 85 to 90% of laboratory dry density. * The Payment shall be made on CUM. Basis of the finished compact volume. Rate shall include cost of materials, handling, compacting, transport for all leads, watering, compaction, Labour and testing etc. complete.   2.8 Rubble Soling   * Rubble laying shall commence on required level in proper grade and on properly cambered sun-base. * Stones shall be hand packed as close as possible and bedded firmly on broadest base. Voids shall be filled with chips and shall stones. The interstices shall be filled up with selected earth. If possible, thick base shall be rolled with 8/10 TON roller, with approximate watering and refilling voids with consent of the Engineer. Further activities will be carried out after approval of the Engineer.   2.9 Curing   * Curing shall be cured by keeping it continuously moist wet for a specified period of time to ensure complete hydration and hardening. * Curing shall be started after 8 hours of placement of concrete under normal condition and in hot weather after 4 hours. * Type of covering which would stain, disfigure or damage the concrete during and after the curing period shall not be used. Only approved covering shall be used for curing. * Curing shall be accomplished in accordance with IS: 456 by keeping the concrete unless otherwise specified. * The approval of the Engineer shall be obtained for method of curing which the contractor purposes to use on the work. * Heavy loads shall not place on or moved across floor slabs until curing is complete. Care shall be taken to prevent floor surface from being marred during curing period. * For freshly laid concrete, formwork shall not be jarred. * Concrete placed under water shall be protected from falling earth during and after placing. * Walking on concrete shall not be permitted for at least twenty four hours after it has been placed in the forms and for such additional length of time as the Engineer may direct. * All curing procedure shall be under contractor scope. Only Water provided by Clients. * All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably completed immersed in water if the size of the unit so permit. * Green work shall be protected from rain by suitable covering. Masonry work as it progresses is kept thoroughly well watered on all faces at least 7 days after completion. Proper watering cans with nozzle must be used for this purpose. The top of masonry work shall be kept flooded at the close of the day by forming fillet or mortar 40mm high round the edges of the top course & filled with water. * Cuing shall start 24 hours after the plaster is laid. It shall be kept wet for 7 days. During this period it shall be suitably protected from all damages at the contractor’s expenses as directed. * Floor, waterproofing layer shall be cured for 21 days by flooding the water to 25mm depth in panel of 1M x 1M formed by weak cement mortar bonding. |

**3.0 STRUCTURAL WORK**

3.1 General

* Contractor shall furnish all labor, supervision, cranes, material handling equipment, testing equipment, consumables, scaffolding, and materials required to unload assemble, install, level, align, blasting and paint , Final touch up of the Structural equipment.
* All work shall be done in accordance with project drawings, Consultant Instruction, and the best construction work practices applicable.
* The Contractor shall review the extent of work, type of work, and Structure to be erected. The Contractor is responsible for all assembly required making the equipment operable.
* This may include work not shown on the drawings but which is a normal part of this type of Erection.
* The Contractor shall at all times keep the area clean from all trash, including equipment packaging. Upon completion, all tools and surplus materials shall be removed from the work area.

3.2 Equipment Unloading and Temporary Storage

* The Contractor shall receive, unload, and check all material and equipment necessary to carry out the work. Contractor shall check packaging for damage during transport and shall notify the Construction Manager of any problems.
* In the event that the equipment cannot be moved immediately to the installation location, the Contractor shall move the equipment to a storage location designated by the Construction Manager.
* The Contractor shall provide blocks and tarpaulins to protect the equipment during storage.

3.3 Structural Fabrication

Scope :

* The fabrication and erection of the steel work consist of accomplishing of all jobs including providing all Labour, tools and plant, all materials and consumables such as welding electrodes, bolts, and nuts, washers, oxygen and acetylene gases, oils for cleaning etc. of approved quality as per relevant IS codes.
* Work shall be executed according to the drawing, specification, relevant codes, etc. in an expeditious and workman like manner, as detailed in the specification and the relevant IS codes and standard practice and to the complete satisfaction of the Engineer.
* Fabrication shall be accordance with IS; 800 and IS: 9595.
* Fabrication shall do as per approved fabrication drawing adhering strictly to work point and work lines on the same. The connections shall be welded or bolted as per design drawing. Work shall also include fabricating built-up sections out of plates or out of a combination of rolled sections.
* Any faulty fabrication pointed out at any stage of work shall be made good by the Contractor at his cost.
* Preparation of materials shall be done by straightened by hot working and cool slowly after straightening.
* Surface of Members that are to be joined by lap of fillet welding or bolting shall be even, so that temporary fastening alignment should not allow passage of a0.2mm thick feeler gauge more than 20mm deep from member edge.
* All Marking accuracy shall be at least +\_ 1mm
* Members shall be cut mechanically or by Cutting Flame. Electric metal arc cutting not allowed.
* All sharp, rough or broken edges of joints which are subjected to tensile or oscillating stresses shall be ground smooth. All edges cut by cutter shall be cleaned of impurities and slab prior to assembly.
* Cutting tolerances for members connected at both ends +-2mm, elsewhere +-3mm.
* Bolts holes shall be only by drilled as per the diameter specified in drawing.
* In case of fabrication daring are prepared by the contractor based on the GA drawing supplied by clients, the correspondence and completeness of the fabrication drawing shall lie with the contractor.
* **Owner** shall only compare the members used in the fabrication drawing with the design drawing. In case of any discrepancy, the contractor shall rectify the bill of materials on the fabrication drawing accordingly. Further, the correctness of cut lengths shown in the fabrication drawing shall be contractor’s responsibility.

**Procedure/ Checklist:**

|  |
| --- |
| Check for Availability of **APPORVED SHOP DRAWING FOR FABRICATIONS** |
| Check for Availability of required structural steel sections, welding rods for fabrication of particular job and readiness of other construction Assistances. |
| Check for straightening of Members. Is it acceptable? |
| Check for Dimensions of sub-assembly. Is it O.K.? |
| Check for **CUTTING** of the section. Is it as specified? |
| Check for **LAYOUT OF SUB-ASSEMBLY**. Is it O.K.? |
| Check for **LAYOUT FOR FINAL ASSEMBLY**. Is it O.k.? |
| Check for **JOINTS PREPARATION**. Is it O.K.? |
| Check for **WELD PREPARATION**. Is it OK? |
| Check for **WELD QUALITY & THICKNESS**. Is it as specified? |
| Check for **SURFACE PREPARATION** prior to painting. |
| Check for **PAINTING** as per specifications. Is it O.K.? |
| Check for Lifting & Transportation Arrangements prior to erection. |
| Check for **COMPLETION OF JOINT RECORDS FOR INSPECTION**. |

**Environment Requirement:**

During work generated scrap of Electrode, MS scrap transfer to identified scrap yard.

**Safety Requirement:**

While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area.

3.4 Structural Welding

* Field welding shall be done by AWS certified welders. Before welding to check respective material WPS/PQR for proper guideline.(As per procedure welder should be tested at site for weld quality and confirm after test report of test coupon)
* Unless noted otherwise, all welds shall be continuous.
* Welding shall not be done when the ambient temperature is lower than that specified in the weld procedure specification or when surfaces are wet.
* Surfaces to be welded shall be cleaned of scale, rust, grease or other debris that would adversely affect the quality of the weld.
* All welds shall be inspected visually for defects. All welds shall present a uniform profile and be free of cracks, porosity, slag, and weld splatter.
* The Welder shall marks with his identification mark each elements welded by him.
* For Multi-layer welding, before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushings, backing strips shall not be allowed. No unacceptable deformation appears in the welded parts. Due margin is provided to compensate for contraction due to welding to avoid any high permanent stresses. Welding shall correspond to design shape and dimensions.
* The Welding shall not have any defects such as cracks, incomplete penetration and fusion, under-cuts, rough surfaces, burns, blow holes and pitting etc. beyond permissible limits.
* The defects in welds much be rectified according to IS 9595 as per instruction of Engineers.
* A format of WPS and PQR is provided for your reference.

3.5 Structural Erection

* Foundations and anchor bolts supplied by civil contractor must be checked for correct position and level and accepted before beginning work.
* Touchup or other protective coatings applied for protection of the equipment during shipping and storage shall be removed, using suitable solvents or cleaners which will not damage the finish of the components.
* Contractor’s rigging plan must be approved in advance by the Construction Manager. Refer to the equipment drawings for location of lifting lugs and rigging points. Follow instructions for using slings and spreader bars when rigging and lifting the equipment.
* Bolts used to secure Civil Foundation to steel structures shall be installed with one plain washer under the bolt head and one plain and one lock washer under the nut. Mechanical equipment fixed with bolts embedded in masonry or concrete shall use one plain washer and one lock washer under the nut.
* Carry out final tightening of bolts after equipment is in place and properly aligned. Unless a torque value is specified, bolts shall be tightened uniformly without over stressing using the "Turn of Nut" method.
* Bolt threads shall be lubricated and shall be free from rust, dirt, cracks, and nicks or cuts on the threads before tightening.
* During assembly and installation of equipment whenever work is not actually in progress, all openings shall be Barricade.
* Before grouting, all base plates or equipment shall be properly set on shims and filler plates, leveled, aligned and pulled down tight with the anchor bolts. Unless the equipment is provided with jack screws, use shims to achieve the tolerances specified in the manufacturer's installation instructions.
* Grout thickness shall be a minimum of 1 inch or as shown on drawings.
* The method and sequences of erection shall have the prior approval of the Engineer. The erection shall arrange for most economical and specification and such information as may be furnished to his prior to the execution of the contact.
* If additional temporary guys are required to resist wind or seismic forces acting upon components of the finished structure installed by others during the courses of the erection of the steel framing, arrangement for their installation by the erector shall be made free of cost to the Owner.
* It shall be responsibility of the contractor to provide free of cost packing and to cover such floors during the work in progress as may be required by any Audit.

**Procedure:**

|  |
| --- |
| Check for availability of **APPROVED SHOP DRAWINGS FOR ERECTION** |
| Check for availability of fabricated material at the erection site. Also check for **HARD PUNCH MARK** on the structural elements. |
| Check for **READINESS** of the **SITE** for structural erection, i.e. **COMPLETION OF PRECEDING ACTIVITIES**. (EX. DIMENSIONS OF FOUNDATION BOLTS IN TWO SUCCESSIVE COLUMNS) |
| Check for **PROVISION & WORKING CONDITION OF ERECTION ASSISTANCES**. Check for condition of **SLINGS & DESHACKLES**. Are they fit for use? |
| Check for **ERECTION** as per **ERECTION SEQUENCE**. Is it being followed? |
| Check for Bracing of the structures during erection. Is it satisfactory? Check for provision of Nut Bolts. |
| Check for **ALINGMENT, LEVEL, LOCATION, ORIENTATION**, etc. |
| Check for **FIELD WELDING**. Is it as specified? |
| Check for Tying of safety Nets and Use of safety appliances. |
| Check for painting as per specifications. |
| Check for **COMPLETION OF JOINT RECORDS FOR INSPECTION**. |

3.6 Erection of Bracing, Bolting and Alignment

* Column alignments shall be measured with Level machine, plumb, and tolerances shall comply within +-5mm or as specify by consultant or drawing instructions.

3.7 Finish Painting

* The Contractor shall apply Final finish paint to any pre painted and blasting surface. Painting shall not be done when the ambient temperature is lower than that recommended by the paint supplier or when surfaces are wet.
* Surfaces to be painted shall be cleaned of dust, grease or other debris before painting.

A format of SHOT BLASTING AND PAINTING provide for reference.

**4.0 PAINTING**

4.1 General

* This is covers painting of structural steel, varnishing, polishing etc. of both interior & exterior surfaces of wood work, Masonry, concrete plastering, structural and bother misc. Steel items, floor & roof drains as per the given specification , As per applications IS codes or special instruction given by the Engineers.

**4.2 Procedure:**

* Barricading shall be provided to work area to restrict man moment.
* Work to permit for execution will take from concern department.
* Test certificate / Challan checking will be done before application as per manufacturer specifications.
* Marking for identification of piping as per industrial / plant standard will be done by civil department.
* All related Marking & drawings to be shown to Contractor/ supervisor for clear understanding.
* Temporary arrangement like scaffolding, ladder etc. will be provided as per standard & Ensure as per check list.
* Civil department representative will be available throughout the work for giving guidelines & noting observations of the work.
* After completion of painting work, re-barricading will be provided to painting area along with sign boards marking NO ENTRY.
* Work permit to be closed & submitted to EHS department.
* Before closing of work permit ensure the proper housekeeping.

**Environment Requirement:**

* In case of leakages of paint during painting work, spilled paint shall be collected and send to hazardous waste store and further disposed by EHS department.
* Hazardous waste generated during painting such as Empty paint container , used brush and dried paint shall be collected and disposed as hazardous waste to authorized agency by EHS Department

**Safety Requirement:**

While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area

* 1. Inspection and testing**:**
* All the Painting materials brought to site for the purpose of application shall be accompanied by the Manufacturer’s test certificate. In case Such Certificate are not available, the Engineer may direct the contractor to have the materials tested in accordance with relevant IS specification or as specified in the tender at outside laboratories and all costs there of shall be borne by contractor.
* The Engineer may call for additional tests in materials accompanied by manufacture’s test certificate. Contractor shall arrange to have such tests performed but costs thereof shall be born by the owner
* The work will be subjected to inspection by Engineers at all times. In particular, following staged inspection will be performed and contractor shall offer the work for inspection and approval at every stage before proceeding with the next stage.

1. Surface Preparation
2. Primer Application
3. Each coat of Paint

* Final Inspection shall include Measurement of paint film thickness, check of finish obtained and adhesion test as per IS specification.
* The contractor shall provide for the purpose of inspection, Elcometer, access, ladders, lighting, and any other necessary items at his cost.
* If with specified numbers of coats specified Dry film Thickness (D.F.T) is not obtained, contractor will have to apply additional coat to achieve the required thickness of DFT without any extra cost. However, specified numbers of coats have to be applied even if required DFT is obtained with lesser number of coats.

**5.0 Roofing Work –**

The contractor shall furnish all labors, materials, tools and services necessary to complete all A.C. sheeting work in roof sheeting, louvers, side cladding in accordance with drawing and the specified them.

The completed surface shall be leak-proof against rainwater and rigidly attached to the structural frame of the building.

Final coat of paint on steel members shall have dried for at least 24 hours before the erection is started. All holes shall be accurately drilled as specified by manufacturer, and laps shall be made over the structural members and sheeting shall be bolted as spacing not greater than those specified by the manufacturer or as directed by the Engineer.

The payment of Sheeting, cladding, glazing shall be on SQM basis on finished area. And other accessories shall be on RM basis on finished area.

**Environment Requirement:**

During work generated scrap transfer to identified scrap yard.

**Safety Requirement:**

While carrying out this activity, work permit shall follow strictly & barricading shall provide to work area.

**6.0 CODES AND STANDARDS**

**6.1 General Specifications of Materials.**

* **Structural Steel:-** Structural steel shall generally be of standard quality conforming to IS:2062 Grade A. Whenever welded construction is specified, plates of more than 20mm thk. Shall conform to IS: 2062 grade B.
* **Welding Materials: -** Welding materials shall conform to IS: 814. Approval of welding procedures shall be as per IS:9595/823
* **Bolts, Nuts and Washers: -** Bolts and Nuts shall be as per IS: 1367 Class 4.6 (UNO) and tested as per IS: 1608. It shall have a minimum tensile strength of 44kg/mm and minimum elongation of 23% on a gauge of 5.65 x A (A = Original cross sectional area). Washers shall be as per IS : 2016

All Materials shall conform to their respective specifications. Equivalent or higher grade or alternate materials will consider only in very special cases subject to the approval of the Engineer in writing.

Aluminum section shall conform to IS: 733, IS: 1948, IS: 1949 as applicable. Contractor shall produce necessary quality assurance certificates for the material to be used for Engineers approval.

* **Fabrication Drawing: -** The contractor shall prepare all fabrication and erection drawing on the basis of general layout drawing; drawings applied to him and submit the same in triplicate to the Engineer for review. The Engineer shall review and comment, if any, on the same. Such review, if any, by the Engineer does not relieve the contractor of any of his required guarantee/responsibilities.
* **Galvanising :**- Galvanising of materials shall be carried out as per IS:2629 –recommended practice for Hot Dip galvanizing of Iron & Steel, which guarantees a minimum coating of zinc of 85 microns.

Work shall comply with the latest edition of the attached standards:

**7.0 FIELD QUALITY CONTROL**

Contractor is responsible for completing the work in a professional manner using modern construction methods.

* Welding procedure specifications must be approved in advance by the Construction Manager or third party inspector.
* After welder test PQR to be fulfilled by contractor to carry out welding work with quality control documents.
* Contractor should strictly produce stage wise inspection in field with quality documents signed by construction manager or TPI.
* Contractor should strictly produce stage wise inspection report before Close the work. After work completion contractor has to submit all documentation to construction manager.
* The inspection shall be so scheduled as to provide the minimum interruption to the work of the Contractor.
* The Contractor shall maintain all documents of quality control, inspection in good order to ensure easy accessibility.
* Materials or workmanship not in reasonable conformance with the provisions of these specifications may be rejected at any time during progress of work.
* The quality control procedure shall cover but not be limited to the following items of work:-
* Steel – Test Certificate, test reports of representative samples of materials from stocks.
* Rivers, Bolts – Manufacturer’s certificate Nuts and Washers dimension checks, material testing.
* Electrodes – Manufacturer’s certificate, thickness and quality of flux coating.
* Welders – qualifying tests
* Welding Sets – Performance tests.
* Welds – Visual inspection, DP and ultrasonic test.
* Paints - Manufacturer’s certificate, physical inspection reports.
* Galvanizing – Tests as per IS:2633 – Method of testing uniformity of coating on Zinc coated Articles and IS:4579 – Specification for Hot Dip Zinc coatings on structural Steel and other allied products.

A format of reports provide for your reference.