TYPICAL
ERECTION METHOD STATEMENT
APPLIED FOR ALL KIRBY’S PROJECTS
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Content</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>2</td>
</tr>
<tr>
<td>1  INTRODUCTION</td>
<td>4</td>
</tr>
<tr>
<td>2  APPLICATION CODE</td>
<td>4</td>
</tr>
<tr>
<td>3  UNLOADING, ARRANGEMENT, STORAGE AND PROTECT MATERIAL</td>
<td>9</td>
</tr>
<tr>
<td>3.1 UNLOADING</td>
<td>9</td>
</tr>
<tr>
<td>3.2 MATERIAL ARRANGEMENT</td>
<td>10</td>
</tr>
<tr>
<td>3.3 PROTECTION &amp; STORAGE MATERIALS</td>
<td>10</td>
</tr>
<tr>
<td>4  ERECTION</td>
<td>12</td>
</tr>
<tr>
<td>4.1 GENERAL PRINCIPLE</td>
<td>12</td>
</tr>
<tr>
<td>4.2 MEMBER ASSEMBLANCE</td>
<td>12</td>
</tr>
<tr>
<td>5  MAIN FRAME ERECTION</td>
<td>13</td>
</tr>
<tr>
<td>5.1 COLUMN ERECTION:</td>
<td>13</td>
</tr>
<tr>
<td>5.1.1 Preparation</td>
<td>13</td>
</tr>
<tr>
<td>5.1.2 Erection</td>
<td>13</td>
</tr>
<tr>
<td>5.2 RAFTER ERECTION:</td>
<td>13</td>
</tr>
<tr>
<td>5.2.1 Preparation</td>
<td>13</td>
</tr>
<tr>
<td>5.2.2 Erection</td>
<td>14</td>
</tr>
<tr>
<td>5.3 ERECTION SEQUENCE</td>
<td>14</td>
</tr>
<tr>
<td>5.3.1 Braced bay erection</td>
<td>14</td>
</tr>
<tr>
<td>5.3.2 Remaining frames erection</td>
<td>15</td>
</tr>
<tr>
<td>5.3.3 Finish Frames &amp; Accessories</td>
<td>15</td>
</tr>
<tr>
<td>6  SHEETING</td>
<td>16</td>
</tr>
<tr>
<td>6.1 ROOFING</td>
<td>16</td>
</tr>
<tr>
<td>6.1.1 Preparation</td>
<td>16</td>
</tr>
<tr>
<td>6.1.2 Complete Sagrod</td>
<td>16</td>
</tr>
<tr>
<td>6.1.3 Install wire mesh, NFR and insulation sheets</td>
<td>16</td>
</tr>
<tr>
<td>6.1.4 Lifting roof sheet:</td>
<td>16</td>
</tr>
<tr>
<td>6.1.5 Install roof sheets</td>
<td>17</td>
</tr>
<tr>
<td>6.1.6 Walking On The Roof</td>
<td>19</td>
</tr>
<tr>
<td>6.2 CLADDING</td>
<td>19</td>
</tr>
</tbody>
</table>
6.2.1 Preparation..................................................................................................................19
6.2.2 Lifting wall sheet:........................................................................................................19
6.2.3 Install cladding .............................................................................................................20
7 SAFETY REQUIREMENT .....................................................................................................21
8 APENDIX 01 INSPECTION CRITERION ...........................................................................25
8.1 BOLT TIGHTENING:........................................................................................................25
8.1.1 TURN OF NUT .............................................................................................................25
8.1.2 TORQUE WRENCH ....................................................................................................25
8.2 FRAME PLUMBING-DEFLECTION CRITERION:............................................................25
8.3 ANCHOR BOLT TIGHTENING ........................................................................................26
8.4 CRANE RUNWAY BEAM ERECTION .............................................................................27
8.5 APENDIX 02 FRAME PLUMBING ..................................................................................28
8.5.1 By mean of Plumb bob ...............................................................................................28
8.5.2 By mean of Transit .......................................................................................................29
8.6 APENDIX 03 – ROD BRACING INSTALLATION ............................................................30
8.7 APENDIX 04 – RIGID FRAME DETAILS INSTALLATION .............................................31
9 REFERENCES ....................................................................................................................32
1 OBJECTIVE

To ensure the management for the erection work on customer job site safely, correctly and comply with KIRBY SOUTHEAST ASIA CO., LTD standards.

2 SCOPE

Applied to all job site with products supplied by KIRBY SOUTHEAST ASIA CO., LTD

3 APPLICATION CODE


During Erection period, all requirements of Vietnamese code will be applied.

4 KEY PROJECT TEAM POSITION AND JOB DESCRIPTION

4.1 Project Manager

The Project Manager is in charge of the proper implementation of Project, reports to the Kirby SEA Board of Management. With main responsibilities as below:

- Full responsible for providing the client services, date, reports, other necessary to complete the work within the required safety condition, established cost budget and scheduled completion date.
- Plan and conduct all the related activities to accomplish project timely, with quality, safety as committed.
- Reviews and approves official letters, drawing, documents for erection purposes.
- Sign-off the submitted detailed installation schedule of the Erector.
- Allocate Resources as required and ensure Resources are properly qualified.
- Responsible the client’s payment progress in line of the delivery and installation schedule.
- Plan, check and get the design manager sign-off the “Sequence/Method of Erection”
- Ensure the adequate plans and actions to solve out all the complaints from the clients.
- Sign-off or get the authorized sign-off for all the non-conformance.
- Check and record all the required test and inspection documents.
4.2 Site Manager

The Site Manager is fully on behalf of Project Manager to manage all the activities happen on site, directly report to the Project Manager with the main responsibilities as below:

- Plan and schedule material, equipment and personnel to perform the work.
- Coordinate all installation, delivery, and safety activities at site.
- Implements and maintains safe working environment by adhering to correct work practices and procedures.
- Make the appropriate “Method Statement” to submit to Project Manager.
- Ensures all necessary checks, inspections and tests are carried out and passed before proceeding to next stage of installation.
- And out going materials from site.
- On behalf of the Project manager on site to decide the issues with his assigned authority.
- Ensures that the work is carried out on site in accordance to the latest approved drawings and specifications at the time of execution.
- Ensures that the work is carried out on site safely.
- To monitor all site staff to carry out the Project effectively
- Perform risk assessment
- Review drawings, Specifications

4.3 Safety officer

- Reporting
- The Safety officer is to report to the Site Manager and Safety Manager.
- Main Responsibilities
- Liaise with Client Safety officer to make sure the Kirby SEA safety system is comply with Client safety system.
- Organize site safety system.
- Prepare safety training to all staff and workers who working on site
- Prepare safety risk assessment.
- Analyze all safety information; records to raise and recognize new risks and hazards may occur during construction period.
- Sets up the filing system
- Attends all Safety Meeting
4.4 Erection Superintendent

- Reporting
- The Erection Superintendent is to report to the Site Manager and Project Manager
- Main Responsibilities
- Monitoring the Erection team to make sure the Erection work was processed in line with project schedule, designed quality and approved safety procedures.
- Follow the ITP, checklist to carry out site inspection with the Erection Team to make sure all inspection steps were done adequately.
- Liaise closely with the Civil contractor to raise timely any of disagreement was found.
- Sign off acceptances with Client inspector for the KIRBY’s works done on site
- Prepare Site daily report for his scope of works.

4.5 Erection Team

- Reporting
- To report to the Erection Superintendents.
- Main Responsibilities
- Process the Erection work in line with project schedule, designed quality and approved safety procedures.
- Follow strictly all instructions of Erection Superintendents.
- Prepare adequately, qualified labors, machines, equipments to process the Erection effectively.
- Organize and monitor all team members about every aspect.
- Prepare toolbox meeting, safety training course to train team members about safety.

4.6 Team Leader (Sub-installer)

- Everyday morning, enter the Safety Tool Box Meeting with the Safety Officer before starting the work.
- Organize the work for groups in day to day operation.
- Performs 100% pre-checks and pre-inspections before the Site Supervisor do the official checks and inspections.

4.7 Material Controller (Sub-installer)

- Responsible for the storage of the materials.
- Controls incoming and out going materials from store.
5 WORK EXECUTION PROCESS

5.1 Job Site Planning & Preparation

- Make sure there is space and firmed pathway for truck delivery, crane truck erection operation. The suitable truck & crane capacity must be clarified (and listed in the equipment register).
- Survey the wind direction to have plan for roof material storage and installation direction.
- Decide the plan for unloading and material storage. Choose a firm and dry location. Materials shall be stored in designated areas for each building and clearly identified for their location in that area. Make sure that materials supply and storage schedule is appropriate and not conflict with the installation schedule and other sub-contractors’ schedules.
- Register the available power & water supply source locations at the site. Make sure there is a safe method to lead the supply to the working area.

5.2 Receiving Of Material At Site

- All delivery to site shall be informed by production people to the site manager 24 hours earlier to have plan for unloading.
- A delivery note is always enclosed with the supplied materials to clarify name of project, location, building number, type of materials, quantity, date of delivery, etc.…
- Upon arrival of materials at the storage yard, the material controller will match delivery notes and shall verify the consignment. The material controller, then, report to the site supervisor the received material list and quality condition.
- Unloading can be done manually or with cranes. A spreader should be used for lifting long components. Lifting nylon or cloth belts with suitable SWL shall be used for unloading the materials to minimize the damage. Be sure to hook belts to component with the right no. of points and position so that the load of component itself do not damaged or broken.
- Always attach a tag line to the lifting component.
- All materials receipt at site shall be visually inspected by site supervisor for any damage. Remedial works to the damage shall be taken immediately, if possible, to avoid any delay to erection.

1.1 Sequence Of Erection

The structural frames and other parts of the building can be erected in various ways which will depend on the following key factors:

- The type of structures such as: small clear span, large clear span, low rise building, high building, taper I structure, open-web structure, etc…
- The availability of equipment such as cranes, winch, manually lift, etc…
- The site condition.
- The experience level of the erectors.
- The individual job conditions.
- The sequence/method of erection shall be studied and planned so that execution can be carried out in a safe, economical and efficient manner.
- There are certain erection practices which are in general use and have proven sound over the years. Below are typical instruction applied for a single/double span structure.
6 UNLOADING, ARRANGEMENT, STORAGE AND PROTECT MATERIAL

6.1 UNLOADING

Materials were shipped to job site separately or on the skid put in container. They are unloaded by crane of worker manually up to the material properties.

The average load of trucks carried materials is about 40 ton, this load is also the safety working load of crane 20 ton. Therefore, the temporary road in the job site must be prepared properly for crane and trucks working.

Before unloading materials out of trucks or containers, it is required to take pictures of real material status delivered to job site.
6.2 MATERIAL ARRANGEMENT

To avoid materials being moved so much on jobsite that might cause unexpected damages of paint, shapes, when material delved to job site, they must be unloaded and arranged closed to the designed erection point. Up to The materials shall be stacked in locations according to the building/areas, should be near to the lifting position adjacent to the area to be erected. This is to facilitate the sorting and delivery during the erection.

the conditions of each job site, the material arrangement plan may different but in generally, materials will be arranges as following principle to ease moving, combination and erection after later.

- Members should be checked parkmark as packing list enclosed before unloading for best unloaded positions.
- Columns should be arranged closed to their anchor bolt position.
- Rafter members should be arranged to ensure easy assembly, movement.
- Girts, purlins, eave struts and bracing are divided according to the requirements of each bay.
- Nested parts (purlins, girts etc.) should be separated and blocked to allow drainage of collected moisture to prevent rusting, prior to erection.
- End wall material is laid out for each end.
- Small components (nuts, bolts, clips, fasteners etc.) are stored in a given area convenient to all parts of the building.
- Wall, roof paneling and other components which will not be used in the initial stage of erecting the steel, are placed to the outside of the work area and properly stored and protected from the weather.
- Insulation should not be stored on the edge of the roll as this will damage the edges

6.3 PROTECTION & STORAGE MATERIALS AT SITE

With purpose of preventing and protecting material damages during storage out of environment factors such as storm water, dust, etc which cause rusty, stain, etc. Including below tasks:
- Choose firmed and dry area for storage.
- The material shall be stored above ground level with timber packing.
- The materials or component or member shall be stored separately, above ground on timber dunnage. They shall not be stacked directly on top of each other but must be separated by 50mm thick timber, and shall not stack in contact with other steel member but must be separated by a minimum 250mm gap.

- Particular care shall be taken to stiffen free ends at 200mm distance from ends, prevent permanent distortion.

- The materials should be placed in minimum 5% slope to avoid water pond.

- The materials shall be kept free from dirt, grease, and other foreign materials and shall be protected from road splash.

- Never step on the materials.

- All bolts, nuts, washers, screws, small plates and articles generally shall be suitably packed and identified.

- Block above ground to keep water out.

- Slope bundles for drainage.

- Stack sheeting with spacers between bundles.

- Cover with canvas tarpaulin to protect from rain

- Tie down cover ends away from stack to permit air circulation. Do not wrap under or restrict air movement.

**IMPORTANT!** Do not use plastic sheeting as a cover because it will promote moisture.

- Sheeting, wire mesh, insulation should be installed right after delivering to job site, if not must be kept indoors. Where indoor storage is not possible, the above procedure must be applied.
7 ERECTION

7.1 GENERAL PRINCIPLE

- Do not conduct erection without last Erection drawings issued for Erection.

- Adequately bracing before releasing lifting equipments or temporarily stop working.

- First braced bay must be completed with rod bracings, eave strut, purlins, girts and flange bracing as well as all connection bolts must be tightened to ensure the stable place for next structures connections.

- Only erect rafter after all connections bolts were tighten, rafter was cleaned and rafter was signed off.

- All connection joints must be completed bolt tightening before releasing lifting equipment.

7.2 MEMBER ASSEMBLANCE

- All assembled members should be bristled by timber bar, cleaned, painted touch up.

- Flange braces should be installed to rafter members then.

- Connection bolts must be tightened, and checked on the ground by TURN OF NUT or Torque Wrench method (see appendix 01).
8 MAIN FRAME ERECTION

- Repeat procedure of erection columns, rafters to complete frames.

8.1 COLUMN ERECTION:

8.1.1 Preparation

- Column materials were arranged closed to design position.
- Columns materials need to be cleaned, paint touching up and assembled before erection.
- Attach driven rope to column
- Check level and position of level nuts and anchor bolts with design.
- Check at least 03 temporary anchor points to ensure safe anchor points for column after erection. These points should be adjacent casted concrete structures (stump, ground beam) where temporary cable can be tied to. In case of no anchor point available, steel members that are not yet in use can be temporary applied for temporary anchor point.
- Tempory anchor points should be arranged out of working area to avoid hanging materials can be caught by temporary cable, this can cause collapse to erected structures.
- Check lifting weight, crane position with capacity of applied crane base on crane specification issued by manufacturer.

8.1.2 Erection

- Lift column and move slightly to design position.
- Slightly down column on casted anchor bolts.
- Tighten anchor bolts nut after column in right position.
- Temporary cables will be applied to keep column in position.

8.2 RAFTER ERECTION:

8.2.1 Preparation

- As the procedure shown in 4.2
- Install static line poles, static line and driven ropes into assembled rafter. Make sure all mentioned equipment was checked strictly.
- Scaffolding should be prepared for workers to perform rafter-rafter, raftercolumn connection.
- Check at least 03 temporary anchor points to ensure safe anchor points for column after erection. These points should be adjacent casted concrete structures (stump, ground beam) where temporary cable can be tied to. In case of no anchor point available, steel members that are not yet in use can be temporary applied for temporary anchor point.
- Temporary anchor points should be arranged out of working area to avoid hanging materials can be caught by temporary cable, this can cause collapse to erected structures.
- Check lifting weight, crane position with capacity of applied crane base on crane specification issued by manufacturer

8.2.2 Erection

- Lift slightly rafter up
- Workers on the ground will drive rafter to right position in coordination with crane.
- Workers standing on scaffolding will adjust rafter for bolting.
- After rafter was connected to right positions, workers will follow rafter with PPE attached to static lines to install temporary purlins, rod bracings, flange braces.
- Crane is only released when all connection bolts were tighten, temporary bracings, bracing purlins, flange braces were installed adequately.
- Make sure there are at least 02 braced purlins were installed for each rafter portion when there are much more than 01 rafter portions.
- Temporary cables will be applied during mainframe erection period, up to certain case, the number of these cable can be deducted to avoid blocking erection process.

8.3 ERECTION SEQUENCE

8.3.1 Braced bay erection

- Braced bay must be erected in priority
- After completion 02 frames of braced bay, all components such as brace rod, flange brace, etc of this bay must be completed as design, to set up the space stable place for next frames. Temporary bracing should be applied for this bay during erection for safety.
- Braced bay frames must be temporarily aligned before installation purlins, bracings to avoid difficulties may get if conducting alignment for remained frames after that.
- After completion frames alignment, request to have approval of Client before sheeting task
- Alignment Method is performed in Appendix 03
- Filling grouting should be done before sheeting.
8.3.2 Remaining frames erection

- Proceed with the erection of the remaining frames and bearing end frames.
- In each braced bay shown on the erection drawings, repeat step 5.3.1 before proceeding with the erection of additional bays.
- Eave struts and peak purlins may be installed in intermediate bays between braced bays to stabilize frames, however, do not start more work than can be completed in a work day to ensure all structural framing is completed in those bays before leaving the site at the end of the day.
- As erection progresses, each braced bay must be fully completed as outlined in step 5.3.1 before proceeding with the erection of additional bays.

8.3.3 Finish Frames & Accessories

- Complete erection of main and secondary framing
- Upon Completion of all secondary framing in the braced bay, plumbing and squaring the braced bay, installing secondary framing in the end bay, paneling may commence and be worked in conjunction with the completion of the balance of the secondary framing. This could save time on larger buildings if separate sheeting crews are used.
- When the building reaches this stage of erection, sheeting should proceed immediately. The structure without sheeting should not be left standing for prolonged periods of time without taking proper precautions (temporary bracing, blocking etc.) to prevent wind damage especially to purlins and girts due to excessive vibration they are exposed to in the unsheeted condition.
9 SHEETING

9.1 ROOFING

9.1.1 Preparation

Before sheeting, all the tasks below must be completed:
- The Period Completion Report of mainframes must be approved and signed off by Client.
- All column baseplates must be filled grouting strong enough for support loading.
- Frames must be completed painting touch up and checked.
- Safety net was installed below right after completion of all purlins.

9.1.2 Complete Sagrod

- After installation of safety net, workers will push the Chanels, which put across purlins along
  purlins for sag rod installation.
- PPE will be attached to purlins for safety

9.1.3 Install wire mesh, NFR and insulation sheets

- They all shipped to job site in shape of coils.
- Because of light weight, they all lifted onto the roof by hand and installed by lying from the ridge
  of the roof to the eaves.

- Insulation sheet will be laid on the strip of installed wire mesh or NFR
- NFR is installed by sticking on 02 size tape stuck on to the top face of purlins.
- Roof sheets must be installed right after completing each strip of insulation sheet to avoid the insulation sheet being
damaged by rain or wind.

9.1.4 Lifting roof sheet:

Roof sheet will be lifted on to the roof by crane or manually
by workers.
(a). Lifting by crane
- Roof sheets will be piled up to set of 10 sheets then being tied together by soft ropes at space maximum = 4m
- With roof sheet length <25m, 01 crane was applied
- With roof sheet length >25m, 02 cranes was applied

- The spreader bars will be applied for lifting purpose.
- The lifted roof sheets will be arranged to adjacent bays, piled, and tied carefully to purlins until being installed

(b). Lifting manually by workers
- Roof sheet will be moved to right position and pulled sheet by sheet on to the roof by workers sitting on the rafter with PPE attached to static lines.
- Roof sheets lifted on to the roof will be arranged to adjacent bays, pilled and tied safely to purlins before installation.

9.1.5 Install roof sheets
- Roof sheets which are waiting for installation will be tied to purlins by ropes.
- Before install roof sheet, safety net was installed for safety reason.
- Roof sheet must be installed by only 01 way from predetermined end gable of the building, this end gable should be closed to the Rolling machine of position of fabricated roof sheet to avoid moving too much, this might cause damages to them.
- Roof sheet will be installed one by one manually by workers
- KV35, KR32 roof sheet will be attached to purlins by screws while KSS600 by clips and seaming after completing checking.
- All the accessories related to installation sheeting and the order of installation will be complied as sketch below

To the first major Rib given as per erection drawings

<table>
<thead>
<tr>
<th>Direction of panel Kirby rib roof</th>
<th>Sidewall One</th>
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</thead>
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<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
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Distance from steel line to the first major Rib given as per Erection drawings

Notes:
A, C: Kirby roof sheet
B : Kirby peak panel

- Locate the center of the first major rib exactly over steel line or as indicated in the Erection drawing attach panels (A) and (C) and then attach peak panel (B)
- Each side of Kirby panel and the Kirby peak panel must be run in conjunction with each other to ensure correct alignment.
- Refer to other sections of this manual for details relating to eave alignment of roof panels, sealer application and fastener types.
- All damaged paint finishes are to be retouched to prevent rusting.
- In the event a screw is installed in the wrong location or should a screw break during the driving process, remove the screw and install one of the larger diameters to prevent leaking.
- Concentrated heavy loads (personnel or material) occurring on the roof during construction shall be distributed uniformly over a large area in such a manner as to prevent damage to building components.

- All metal shavings occurring as a result of drilling operations on the roof are to be removing in such a manner as to prevent damage or staining of roof finish.” SWEEP ALL DRILL SHAVINGS FROM PANELS AND TRIM DAILY, OR HUMIDITY AND RAIN WILL CAUSE THE SHAVINGS TO RUST OVERNIGHT AND STAIN THE MATERIAL!”

9.1.6 Walking On The Roof

- When walking parallel to the ridge line, step directly over a purblind NOT STEP ON A PANEL MAJOR RIB and DO NOT WALK ON ANY PANEL THAT HAS NOT BEEN PROPERLY SECURED TO THE STRUCTURE.

- When walking up-slope or down-slope, step to either side of a major rib.

- A life line is to installed along to sheeting way for worker hooking their PPE to Life line for roof sheeting

- After completion roof sheet, life lines will be dismantle and re fix 02 ends to major ribs of roof.

9.2 CLADDING

9.2.1 Preparation

- Wall sheets were fabricated in Plant and shipped to job site in packages.

- Before installing sheeting, make sure all girts and sag rods were completed.

- A set on scaffolding will be use for cladding, a pulley will be installed on scaffolding, and this allows pulling wall sheet safely by people on the ground or on the scaffolding.

- Wall panel will be moved to their position along the wall to install.

9.2.2 Lifting wall sheet:

- Drill a hole with dia. of 12mm at the middle of the wall panel 150mm far from the top for hooking wire rope to the wall panel.

- Lift up and adjust panel to right position before attached to the girt.

- Workers working on scaffolding must wear PPE attached to scaffolding, which
is also kept stable by struts tube to the ground.

9.2.3 Install cladding

- A steel ladder as sketch will be used for girt installation.

- Worker stand on ladder which stand on ground and attached to girts to avoid fall down, will fix cladding to the girts

- Need to be install a thread to make sure the screws were installed straight

- Platform for cladding must be flat strong enough. In case this requirement is not met, Kirby supervisor have to contact to Client immediately to solve by RFI.
10 SAFETY

10.1 PERSONAL PROTECTIVE EQUIPMENT (PPE):

- The workers working on job site must be equipped with minimum PPE as below:
  - Safety Helmet
  - Safety shoes, Soft shoes when working on the roof otherwise safety shoe all the time
  - Full body safety harness with 01 or 02 hooks
  - High visibility vest
  - Safety gloves
10.1.1 Hard Hat – Safety Helmet

10.1.2 Soft shoes applied for those who work on roof or steel structure. Safety shoes are required for that work on ground level. / Giày để mèm đôi với công nhân làm việc trên cao hoặc trên các kết cấu. Giày an toàn với công nhân làm việc trên mặt đất.

10.1.3 PEB uniform with high visibility / Đồng phục của Kirby.

10.1.4 Job Specific PPE

10.1.5 Full body harness (for all workers working at heights and must be attached to static line at all times) / Đeo dây an toàn thân (cho tất cả công nhân làm việc trên cao và phải mặc vào cấp cứu sinh trong suốt thời gian).

10.1.6 Gloves when handling steel sheet / Găng tay an toàn khi mang thép.

10.1.7 Face shield (for grinding, cutting …) / Mặt nạ bảo vệ (khi hàn, cắt …).

10.1.8 Ear Protection (working near generator, or high noise level areas) / Đeo bì tai khi tiếp xúc với tiếng ồn lớn hơn 85dBA.

10.1.9 Additional Requirements / Yêu cầu thêm:

- Work permit card to be worn by all personal working on site / Thẻ cho phép làm việc được đeo bởi tất cả mọi người làm việc tại công trường.
- Visitor cards for visitors / Thẻ khách cho khách thăm quan.
- All erector workers and sub contractors must attend induction training prior to commencing work at site.
- A toolbox meeting must be held at the start of every shift. The purpose of the toolbox meeting is to communicate the work to be done during that shift, the hazards involved and the control measures in place to manage the risk.
- The other special requirements such as Safety glass, ear muffler etc will follow with site requirement individually
- Static lines should be used to ensure safe anchor points for safety harnesses.
- Workers must be warned about opened holes on the roof. Any of opened holes with out cover must be protect carefully.
- Workers are not allowed go up and down by columns or others structures, ladder, scaffolding must be used for this purpose.
- No drinking allow before entering job site.
- Safety nets shall be installed for roofing, and being hung far enough above objects below so that the net does not contact lower objects.

- Safe access must be provided to the roof at all times. The most common method for roof access is by using scaffold specifically installed for this purpose.
APPENDIX
11 APENDIX 01 INSPECTION CRITERION

- Applied code for inspection of erection and fabrication is AISC & MBMA

11.1 BOLT TIGHTENING:

- Bolts will be tightened by method of TURN OF NUT or TORQUE WRENCH.

11.1.1 TURN OF NUT

- A method of tightening bolts in a connection. A rotation of the nut through 1/2 to ¾ turn beyond a ‘snug’ position will produce at least the desired minimum tension on the bolt. (“Snug” is defined as the point at which the material between the bolt head and the nut is rigid. If power tools are used, “snug” would be the point at which the wrench begins to impact).

11.1.2 TORQUE WRENCH

- A wrench containing an adjustable mechanism for measuring and controlling the amount of torque of turning force to be exerted used to tighten nuts on high strength bolts as follow table.

<table>
<thead>
<tr>
<th>Bolt nominal diameter (mm)</th>
<th>Bolt diameter (mm2)</th>
<th>Tension force N (kN)</th>
<th>Tightening Torque (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4.6</td>
<td>8.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.6</td>
<td>8.8</td>
</tr>
<tr>
<td>12</td>
<td>84</td>
<td>16</td>
<td>38</td>
</tr>
<tr>
<td>14</td>
<td>115</td>
<td>22</td>
<td>52</td>
</tr>
<tr>
<td>16</td>
<td>157</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>18</td>
<td>192</td>
<td>37</td>
<td>86</td>
</tr>
<tr>
<td>20</td>
<td>245</td>
<td>47</td>
<td>110</td>
</tr>
<tr>
<td>22</td>
<td>303</td>
<td>58</td>
<td>136</td>
</tr>
<tr>
<td>24</td>
<td>353</td>
<td>68</td>
<td>158</td>
</tr>
<tr>
<td>27</td>
<td>459</td>
<td>88</td>
<td>206</td>
</tr>
<tr>
<td>30</td>
<td>561</td>
<td>108</td>
<td>251</td>
</tr>
</tbody>
</table>

11.2 FRAME PLUMBING-DEFLECTION CRITERION:

- All frame members erected as erection drawings issued by Kirby will be complied with follow tolerance.

<table>
<thead>
<tr>
<th>Inspection point</th>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In Frame plan</td>
</tr>
<tr>
<td>Middle of frame</td>
<td>1/180 L</td>
<td>N/A</td>
</tr>
<tr>
<td>Top of column</td>
<td>N/A</td>
<td>1/60 H</td>
</tr>
<tr>
<td>Middle of Girt</td>
<td>1/150</td>
<td>1/90</td>
</tr>
<tr>
<td>Middle of Purlin</td>
<td>1/150</td>
<td>N/A</td>
</tr>
</tbody>
</table>

H : Column height ; L : Frame span
11.3 ANCHOR BOLT TIGHTENING

Anchor bolts shall be brought to a snug-tight condition after the first tier is plumbed and the columns are grouted. Snug tight is defined as the tightness attained by the full effort of a man using an ordinary typical spud wrench (see pictures).

Anchor bolts were applied 02 nuts with the nut at the top called locked nut to avoid losing of nut below.

Figure 1. Spud wrench
# 11.4 CRANE RUNWAY BEAM ERECTION

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Tolerance</th>
<th>Maximum Rate of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Span</strong></td>
<td><img src="image1" alt="Diagram" /></td>
<td>A = 3/8 “</td>
<td>1/4 “/20’</td>
</tr>
<tr>
<td></td>
<td><img src="image2" alt="Diagram" /></td>
<td>(A = 10cm)</td>
<td>(6.3mm / 6m)</td>
</tr>
<tr>
<td><strong>Straightness</strong></td>
<td><img src="image3" alt="Diagram" /></td>
<td>B = 3/8 “</td>
<td>1/4 “/20’</td>
</tr>
<tr>
<td></td>
<td><img src="image4" alt="Diagram" /></td>
<td>(B= 10cm)</td>
<td>(6.3mm / 6m)</td>
</tr>
<tr>
<td><strong>Elevation</strong></td>
<td><img src="image5" alt="Diagram" /></td>
<td>C = 3/8 “</td>
<td>1/4 “/20’</td>
</tr>
<tr>
<td></td>
<td><img src="image6" alt="Diagram" /></td>
<td>(C= 10cm)</td>
<td>(6.3mm / 6m)</td>
</tr>
<tr>
<td><strong>Beam to Beam</strong></td>
<td><img src="image7" alt="Diagram" /></td>
<td>D = 3/8 “</td>
<td>1/4 “/20’</td>
</tr>
<tr>
<td><strong>Top Running</strong></td>
<td><img src="image8" alt="Diagram" /></td>
<td>(D=10cm)</td>
<td>(6.3mm / 6m)</td>
</tr>
<tr>
<td><strong>Beam to Beam</strong></td>
<td><img src="image9" alt="Diagram" /></td>
<td>E = 3/8 “</td>
<td>1/4 “/20’</td>
</tr>
<tr>
<td><strong>Under hung</strong></td>
<td><img src="image10" alt="Diagram" /></td>
<td>(E= 10cm)</td>
<td>(6.3mm / 6m)</td>
</tr>
<tr>
<td><strong>Adjacent</strong></td>
<td><img src="image11" alt="Diagram" /></td>
<td>F = 1/8 “</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Beams</strong></td>
<td><img src="image12" alt="Diagram" /></td>
<td>(F =10cm)</td>
<td></td>
</tr>
</tbody>
</table>
11.5  APPENDIX 02 FRAME PLUMBING

11.5.1  By mean of Plumb bob

- As soon as all purlins, girts and eave struts have been installed in the braced bay, it should be accurately plumbed and squared to insure correct alignment of the succeeding bays. This is accomplished by adjusting the diagonal bracing and temporary bracing in the roof and wall planes.

- With all the rods loosely installed, plumb the columns of the rigid frame by tightening or loosening the nut on the brace rods.

- Remember, when one brace rod is tightened, the other rod must be loosened.

- When columns are plumb, sidewall brace rods should be finally tightened to a “TUT” condition.

- Dimension “B” must be the same as dimension “A” for column to be plumb. See Fig. 1.

- The roof beams should be aligned in progression from the eave to the ridge. Plumb the roof rafter at each connection point and the ridge by tightening or loosening the rods at those points.

- Stretch a line across the flanges at the base of the column. Drop a plumb bob from ridge point of the roof rafter; adjust as necessary so that the plumb bob is in line with line at base of columns. When this occurs the ridge is plumb. See fig. 2.
11.5.2 By mean of Transit

- Locate Transit as shown above.
- Make sure transit is absolutely level.
- Rotate transit until you get the same exact tape reading d at detail A&B. (Base of column. Outside flange-see detail).
- Lock horizontal rotation of Transit.
- Adjust rod bracing until the tape reading at point a&b is obtained at all points indicated on above sketch take all readings from the same surface as “A” & “B” equal (d).
11.6 APENDIX 03 – ROD BRACING INSTALLATION

Wall brace detail at Haunch

Wall brace detail at roof rafter

Wall brace detail at column base

Figure 2 ROD BRACING INSTALLATION
Figure 3 RIGID FRAME DETAILS INSTALLATION
12 REFERENCES

- AISC
- MBMA