



نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



شماره پیمان:

053-073-9184

SPECIFICATION FOR ERECTION OF STEEL STRUCTURES

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
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SPECIFICATION FOR ERECTION OF STEEL STRUCTURES

نگهداشت و افزایش تولید میدان نفتی بینک

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IFC: Issued For Comment
IFA: Issued For Approval
AFD: Approved For Design
AFC: Approved For Construction
AFP: Approved For Purchase
AFQ: Approved For Quotation
IFI: Issued For Information
AB-R: As-Built for CLIENT Review
AB-A: As-Built –Approved



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1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.



GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – General Facilities
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of : Hirgan Energy – Design & Inspection(D&I) Companies
VENDOR:	The firm or person who will fabricate the equipment or material.
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
THIRD PARTY INSPECTOR (TPI):	The firm appointed by EPD/EPC CONTRACTOR (GC) and approved by CLIENT (in writing) for the inspection of goods.
SHALL:	Is used where a provision is mandatory.
SHOULD:	Is used where a provision is advisory only.
WILL:	Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

2.0 SCOPE

This specification covers the minimum requirements for erection of steel structural Such as building, equipment, shelters and supporting which shall be considered in the Project.

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3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

- IPS-C-CE-210 Construction Standard for Steel Structure
- IPS-E-CE-500 Engineering Standard for Loads
- INBC-PART 10 Steel Structure Design & Construction
- INBC-PART 11 Industrial Building Construction
- ISDCOI-038 Iranian Seismic Design Code for Petroleum Facilities & Structures (3rd Edition)
- STD-2800 Iranian Code of Practice for Seismic Resistant Design of Building (4rd Edition)
- PUB-228 Publication No. 228 (Iranian Construction Welding Regulations)
- General Technic Specification for Construction Works, Iranian Ministry of Planning and Budget Publication , Publication No.55

3.2 INTERNATIONAL CODES AND STANDARDS

- ASTM-A325 M Specification for High-Strength Bolts for Structural Steel Joints(Metric)
- ASTM A36/A36M Standard Specification for Carbon Structural Steel
- ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts, Steel and Allow Steel , Heat Treated, 830MPa and 1040MPa Minimum Tensile Strength , Metric Dimensions.
- ASTM-A490 M Specification for High-Strength Steel Bolts. Clauses 10.9 and 10.9.3 for Structural Steel Joints(Metric)
- AISC Steel Construction Manual -13th edition-2005 “Specification for Steel Structural Building”
- ANSI/AISC 303-16 Code of Standard Practice for Steel Buildings and Bridges
- AISC 325 Steel Construction Manual
- AISC 326 Detailing for Steel Construction
- ANSI/AISC 360-10 Specification for Structural Steel Buildings
- ASSE A10.13 Safety Requirements for Steel Erection – American National Standard for Construction and Demolition Operations
- AWS A2.4 American Welding Society, Symbols for Welding, Brazing and Non-destructive Testing
- AWS A.1 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

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- AWS A 5.17 Specification for Steel Electrodes for Fluxes for Submerged Arc Welding
- AWS A3.0 American Welding Society, Welding, Terms and Definitions
- AWS D1.1/D1.1M Structural Welding Code – Steel
- AWS QC1 Specification for AWS Certification of Welding Inspectors
- PIP STS03600 Non-shrink Cementitious Grout Specification
- PIP STS03601 Epoxy Grout Specification
- PIP STS05120 Structural and Miscellaneous Steel Fabrication Specification

3.3 THE PROJECT DOCUMENTS

- BK-GNRAL-PEDCO-000-ST-SP-0003 Specification for Fabrication of Steel Structures

3.4 ENVIRONMENTAL DATA

Refer to "Process Basis of Design; Doc. No. BK-GNRAL-PEDCO-000-PR-DB-0001".



3.5 ORDER OF PRECEDENCE

In case of any conflict between the contents of this document or any discrepancy between this document and other project documents or reference standards, this issue must be reported to the CLIENT. The final decision in this situation will be made by CLIENT.

4.0 REQUIREMENT

4.1 QUALITY CONTROL

- Erector shall be solely responsible for quality control of all installations, workmanship, and erector-supplied materials.
- Provide a written Quality Control Program and Inspection Procedures document that includes details of how compliance with requirements of this Practice and shop and erection drawings will be achieved.
- Maintain a complete up-to-date set of erection drawings at jobsite.
- Bolted connections shall be installed and inspected in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts.
- Welding procedures and individual welders shall be qualified in accordance with the requirements of AWS D1.1/D1.1M.
- All welding shall be inspected in accordance with AWS D1.1/D1.1M.

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- Inspector shall inspect all materials, installations, and workmanship to ensure conformance with all requirements of this Practice and contract documents.
- Purchaser shall have the right to inspect all materials, installations, and workmanship and shall have an unrestricted right of access to work areas.
- Purchaser may reject any improper, inferior, defective, or unsuitable materials, installations, and workmanship.
- Rejected materials, installations, and workmanship shall be repaired or replaced in accordance with purchaser's instructions at no cost to purchaser.
- Inspection tools and tool calibration records for tools used shall be maintained and available for examination by purchaser.
- Nondestructive testing of welded joints shall be performed in accordance with ANSI/AISC 360-10, Chapter N. ANSI/AISC 360-10 requirements for buildings shall also apply to nonbuilding structures.

4.2 SUBMITTALS

- The following items shall be submitted to engineer of record for approval. Work shall not proceed without approval.
 - a. Safety program
 - b. Quality control program and inspection procedures
 - c. Welding Procedure Specification (WPS)
 - d. Procedure Qualification Records (PQR)
 - e. Welder(s) qualification records
- If requested, the following documents shall be submitted to purchaser for recording purposes:
 - a. Quality control inspections and test results
 - b. Calibration or recalibration performed on tools or equipment used during the work.

4.3 PERFORMANCE REQUIREMENTS

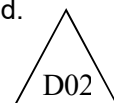
- A written safety program shall be provided that addresses safety measures that will be used during steel erection work.
- Safety program shall be in accordance with:
 - a. Contract documents
 - b. ANSI/AISC 303-16
 - c. Any other applicable federal, state, or local requirements



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- Erector shall be responsible for assuring all preassemblies not specifically shown or noted in contract documents to be preassembled before lifting will maintain structural integrity during lifting.
- a. Provide a written assembly lift plan to purchaser, prepared by a professional engineer, for assemblies larger than 15(meters) in one direction, larger than 186(square meters) in the plan area, greater than 490 (metric tons), or as otherwise specified in contract documents.
- b. Assembly lift plan shall demonstrate that proposed lift will be performed safely and that assemblies being lifted will remain free from distortion or undue bending, and maintain structural integrity during the lift.
- c. Assembly lift plan shall contain detailed data on extent of lifted assembly, its weights, structural calculations that prove structural stability of assembled components during lifting operations, verification of capacity capabilities for any cranes utilized in the lift, location and positioning of cranes, and a description of rigging to be utilized.

4.4 PRODUTS AND MATERIALS

- 1) Stair treads shall be made of gratings with bearing bars 30mm x 3mm spaced.
- 2) High strength bolts shall conform to ISO8.8 and normal bolts to ISO4.6.
- 3) Fixed checkered plates are to be field attached to support members with 3mm intermittent weld 50mm long spaced on approximately 450mm center on all edges with a minimum of two welds per edge.
- 4) All grating shall be removable unless otherwise noted on relevant drawing. All grating and accessories shall be type 30x3 serrated bearing bar hot dip galvanized unless otherwise noted.
- 5) The electrodes used for welding by manual process shall comply and be coded in accordance with AWS (American Welding Society) and shall be approved by the engineer. The weld metal deposited by an automatic or semi-automatic process shall have mechanical properties not less than the minimum specified for the weld metal deposited by electrodes complying with AWS except where otherwise specified in the standard for the particular application. Electrodes shall be stored in their original packets or cartons in a dry place adequately protected from weather effects.



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- 6) All materials specified herein may be substituted by approved equivalents. Written approval of the engineer must be obtained for any substitute materials prior to the fabrication work.
- 7) The fabricator/contractor shall supply all certificates and test reports for materials furnished and where called for by the engineer. Minimum testing requirements shall be as described in inspection data sheet.

4.5 EXECUTION

All materials shall be received, unloaded, stored, and handled in a manner that prevents distortion, deterioration, damage, or staining. Keep all materials free of dirt, grease, and other foreign matter. inspect all materials immediately after receipt to ensure that the materials are not damaged, that all items on the packing list have been supplied, and that all documentation has been received.

If any damage is discovered, or any parts, components, or documentation are missing or otherwise defective, immediately report the occurrence in writing to purchaser.

5.0 ERECTION

5.1 GENERAL



Erection shall be in accordance with the drawings and other contract documents; the AISC Specification for Structural Steel Buildings and the Code of Standard Practice for steel buildings. Loose timbers, metal sheeting, bolt buckets, tools, debris and temporary scaffolding shall be kept restrained or removed from the work areas. All equipment and materials shall be secured within the erectors care, custody and control, during the erection operation. The job site shall be maintained in a clean safe condition and all crating, waste materials and other refuse accumulated as a result of the erection activities shall be properly disposed of to approved dump. The contractor shall furnish all tools, equipment, facilities, scaffolding, temporary guys and bracings and shall perform all labor and services necessary for the proper execution and completion of all structural steel erection as shown on the drawings, as specified herein and/or reasonably implied thereby to carry out the apparent intent of the work.

5.2 STRUCTURAL STABILITY

During erection, temporary bracing and guys shall be used to maintain structural stability as necessary. Temporary erection loads or permanent loads shall not be placed on any incomplete portions of the structure being erected unless it can be demonstrated by analysis that the contemplated action is safe. The structure shall be plumbed, levelled and braced before final bolted or welded connections are made.

5.3 SETTING BASE PLATES

Column base plates shall be set and shimmed to correct positions, elevations, and

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locations as shown on the design drawings. Anchor bolts shall be tightened only after grouting.

5.4 BOLTED CONNECTIONS



Where structural joints are made using high-strength bolt assemblies, the materials methods of installation, tension control including tension measuring devices, types of wrenches to be used and inspection methods shall conform to the AISC Specification for Structural Joints using 8.8 bolts. Bolts that have been previously tightened to their design stress shall not be re-used.

When assembled, all joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of burrs, dirt and other foreign materials that would prevent solid seating of parts.

When impact wrenches are used, wrenches of adequate capacity and sufficient air supply shall be provided to perform the required tightening of each bolt.

Where 4.6 bolt assemblies are used for connecting appurtenances, (such as handrail assemblies, stair framing, stair treads) to structural steel members, the bolts shall be tightened to a snug-tight condition.

High strength bolts shall be marked in order to indicate that they have been properly tensioned and are ready for inspection.

5.5 WELDED CONNECTIONS



Welding shall conform to AWS D1.1 and AWS A5.1 All welds shall be continuous. Field welding shall not be used unless shown on the shop drawings, erection drawings, or other contract documents.

5.6 CORRECTION OF ERRORS

Fitting-up bolts and drift pins shall not be used to bring improperly fabricated members and parts into place thus causing a strain on bolts in finished work. Drift pins shall not be driven with such force so as to damage adjacent metal. Packing, shimming or wedging will not be permitted to correct faulty work. Minor misfits, which can be remedied by a moderate amount of reaming and slight cutting and chipping, may be corrected by CONSTRUCTION CONTRACTOR when, in the opinion of the COMPANY, it will not be detrimental to the strength or appearance of the structure.

5.7 FLOOR PLATE AND GRATING

All field-cut floor plate or grating openings requiring toe-plate protection or banding shall be installed as required on the design drawings. Floor and roof deck sheets shall be installed in accordance with the VENDOR's installation instructions and the contract documents.

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5.8 ERECTION AND SHOP DRAWING

Shop drawings and erection drawings shall be prepared in accordance with the AISC documents listed in this specification.

Erection drawings shall reference the corresponding design drawings. Every steel piece on the shop drawings shall reference the appropriate erection drawing.

Erection and shop drawings shall be grouped in sets and identified separately for each structure or yard area.

Erection drawings shall clearly show the mark number and position for each member. All fabricated steel sections shall be match-marked for field assembly with designating numbers or letters corresponding to the field erection drawings. Match marking of steel shall be done with suitable paint, waterproof ink or with pressed metal tags. In addition to the Fabricator's identification marks, each item or bundle of walkways and platforms shall be marked with a unique tag number to clearly indicate its associated equipment. Each item or bundle of walkways and platforms shall also be indicated in the erection drawings.

Shop drawings shall state the welding procedure to be used.

Surface preparation and shop-applied coatings, including areas to be masked, shall be noted on the shop drawings.

Bolt lists showing the number, grade, size and length of field bolts for each connection shall be supplied. These bolt lists may be shown on either the shop drawings or on separate sheets.

In the event that drawing revisions are necessary, all changes showing the latest revisions shall be clearly flagged on the shop drawings.



A shipping list (including total weight), bolts list, and a minimum of two sets of final erection and shop drawings shall accompany the first shipment of each release.

5.9 ASSEMBLY LIFT PLAN

When necessary, particularly for pipe bridges over 20 m, assembly lift plan shall be issued by erector in order to demonstrate that proposed lift shall be performed safely and that assemblies being lifted shall remain free from distortion, undue bending and will maintain structural integrity, during the lift. Assembly lift plan shall contain detailed data on the extent of the lifted assembly, its weights, the structural calculations that prove structural stability of the assembled components during lifting operations, verification of the capacity capabilities for any cranes utilized in the lift, location and positioning of cranes, and a description of the rigging to be utilized.

5.10 FINAL CLEAN-UP

Upon completion of the erection and before final acceptance, the Contractor shall

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remove all temporary false work. He shall remove all piling, excavated or surplus materials, rubbish and temporary supports, replace or renew any damaged fences, and restore in an acceptable manner all property damaged during the execution of the Work. Disposed of surplus materials shall be in a manner and at a location satisfactory to the Engineer.

The Contractor shall leave site, roadway and adjacent property in a neat restored and presentable condition, satisfactory to the Engineer.

5.11 COLUMNS

The steel column erection starts with placing column bases so the anchor bolts go through the holes and bolting the bases to the anchor bolts, thus affixing the columns to the foundation and creating the backbone of the steel frame structure.

The anchor bolts for the columns were placed when the foundation was poured/foundation walls were completed. The anchor bolts constitute a part of a column base connection, perhaps the most important of all in the whole structure. Column base connections transfer the shear, the axial load, and the flexure of the whole building to the foundation, bearing all those construction loads.



Beams are lifted up either with a help of a crane or by jacking, placed in the position, and bolted to the columns, without tightening, so the resulting steel frame structure can be then aligned by the gang according to the erection engineer's commands.

The alignment takes place and the gang persuades the frame to take the right shape, right after that all bolts are tightened and the steel columns' erection is pretty much completed.

In some cases, welding is used to connect the beams to the columns. It's done by certified welders, using quality welding torches, and following the best practices of the trade.

For an individual column shipping piece, the angular variation of the working line from a plumb line shall be equal to or less than 1/500 of the distance between working points, subject to the following additional limitations :

- For an individual column shipping piece that is adjacent to an elevator shaft, the displacement of member working points shall be equal to or less than 25 mm from the established column line in the first 20 stories. Above this level, an increase in the displacement of 1 mm is permitted for each additional story up to a maximum displacement of 50 mm from the established column line.
- For an exterior individual column shipping piece, the displacement of member working points from the established column line in the first 20 stories shall be equal to or less than 25 mm toward and 50 mm away from the building line. Above this level, an increase in the displacement of 2 mm is permitted for each additional story up to a maximum displacement of 50 mm toward and 75 mm away from the building line.
- For an exterior individual column shipping piece, the member working points at

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any splice level for multi-tier buildings and at the tops of columns for single-tier buildings shall fall within a horizontal envelope, parallel to the building line, that is equal to or less than 38 mm wide for buildings up to 90 m in length. An increase in the width of this horizontal envelope of 13 mm is permitted for each additional 30 m in

- For an exterior column shipping piece, the displacement of member working points from the established column line, parallel to the building line, shall be equal to or less than 50 mm in the first 20 stories. Above this level, an increase in the displacement of 2 mm is permitted for each additional story up to a maximum displacement of 75 mm parallel to the building line.

5.12 MEMBERS CONNECTING TO COLUMNS

When two structural members on opposite sides of a column, or a beam over a column, are connected sharing common connection holes, at least one bolt with its wrench-tight nut shall remain connected to the first member unless a shop-attached or field-attached seat or equivalent connection device is supplied with the member to secure the first member and prevent the column from being displaced.

- For a member that consists of an individual, straight shipping piece without field splices, other than a cantilevered member, the variation in alignment shall be acceptable if it is caused solely by variations in column alignment and/or primary supporting member alignment that are within the permissible variations for the fabrication and erection of such members.
- For a member that consists of an individual, straight shipping piece that connects to a column, the variation in the distance from the member working point to the upper finished splice line of the column shall be equal to or less than plus 5 mm and minus 8 mm.

5.13 OTHER MEMBERS

For members not covered above refer to AISC code of practice clause 7.13.1.2(c) to (h).



5.14 INSPECTION AND TESTING

The COMPANY reserves the right to inspect the materials and fabrication at any time to assure that the materials and workmanship are in accordance with this specification and applicable codes.

Inspection of welding shall be performed in accordance with the Structural Welding Code, AWS D1.1.

A program for inspection and non destructive testing of welds shall be submitted to the COMPANY for approval before the start of the welding operation. The minimum NDT levels will be as follows,

All welds shall be 100% visually inspected the acceptance criteria shall be in accordance with AWS D1.1 Table 6.1.

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In addition all fillet welds on padeyes, trunnions, lifting lugs etc shall be inspected 100% by magnetic particle inspection. All butt welds on padeyes, trunnions, lifting lugs etc shall be 100% volumetrically inspected by UT or radiography. Prior to welding all areas under such lifting points shall be subjected to 100% visual inspection and 100% ultrasonic examination to ensure that the area is free from laminations.

All main beam splices shall be additionally subjected to 100% radiography or ultrasonic inspection and all other major load bearing welds shall be subjected to 10% magnetic particle inspection. Alternatively 10% RT of butt welds greater than 75 cm².

Acceptance criteria for radiographic, ultrasonic and magnetic particle inspection shall be in accordance with AWS D1.1.

Certified mill test reports for each heat of structural steel and each lot of high-strength bolts shall be available for review by the COMPANY.

All materials shall be inspected immediately after receipt on site in order to ensure that the materials are not damaged, to verify that all the items on the packing list have been supplied and to ensure that all documentation has been received.

Shop inspection shall include, but not be limited to, the following:

Verification of conformance of materials with this specification and the drawings. The limits of acceptability and repair of surface imperfections for structural steel shall be in accordance with ASTM A6/A6M.



Inspection of high-strength bolted connections shall be in accordance with AISC "Specification for Structural Joints using ASTM A325 or A490 bolts".

5.15 METHOD OF ERECTION

Not later than one week prior to commencing erection, EPC Contractor shall submit to OWNER representative, details of the equipment and method he proposes to use in the erection of the steelwork. The methods and equipment shall be subject to review by OWNER but the EPC Contractor shall remain wholly responsible for the adequacy and safety of the work.

During erection, the existing and new structural steelwork shall be made safe against the wind and all erection stresses and loading conditions, including those due to erection equipment, by adequate bolting guying or temporary bracing. Permanent bolting or welding shall not be carried out unless correct alignment has been obtained in each member of the structure within the tolerances specified. Erection shall not commence before the concrete in support structure has acquired sufficient strength as determined by the OWNER.

Additional members used to facilitate erection shall be connected in a manner that does not weaken the steelwork. Erection methods shall comply with the requirements of the relevant equipment and working conditions of the existing plant.

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5.16 EXISTING SERVICES AND INSTALLATIONS

The contractor shall make himself familiar with the location of all services above and below ground and shall take all reasonable precautions to prevent damage thereto. No props or supports shall be attached or affixed to such services.

The contractor shall be responsible for the safety and for any damage occasioned to installations and services through or in consequence of his operations.

5.17 ASSEMBLY

EPC Contractor shall issue description of the erection procedure to be applied in site. This description shall contain information on the total weight of the structure, weights and dimensions of the heaviest components, tools and machinery necessary for the erection, provisional bracing and securing, estimated time consumption for the erection and description of special precaution or conditions, if any, to be observed during erection.

Erection shall be carried out by skilled personnel and the final structure shall comply with good workmanship.

A check shall be made before erection that the structure elements do not diverge in shape from that guaranteed by the manufacturer of the elements Any damage caused by transportation, storage etc., shall be repaired before the structure is finally assembled

After assembly, the various members forming parts of a completed frame or structure shall be aligned and adjusted accurately before being permanently fastened.



Tolerances shall conform to AISC code of standard practice fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.

Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. As erection progresses, the work shall be securely fastened or braced to take care of all dead load, wind, and erection stresses. Any modification or correction made during erection shall be carried out with good workmanship and the result shall correspond to the shop work.

5.18 ERECTION OF THE STEEL STRUCTURE

The levels, alignments, lines and elevations shall be checked to verify the conformity with the drawings before the start . The structures shall be accurately assembled in accordance with the numbering of each piece and verifying the conformity with the erection drawing and the design tolerances of the erection and in advance in order to have the time for remedial work in case of nonconformity.

The alignment and the verticality shall be checked during the various stages of the erection, in order to avoid accidental errors and ensure the conformity with the design documents.

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Before bolting, the bearing surface shall be cleaned of scale, rust, oil and grease with brushing, hammering or grinding. All the structure shall be grouted only after the approval of the OWNER's supervisor and the checking of the alignment and verticality. Welding shall be applied only when specifically called on the construction drawings or with the prior approval of the OWNER.

All welds shall be executed in accordance with the ANSI / AWS D1.1 (structural welding code)

5.19 ADJUSTMENT DURING ERECTION

The adjusting of small differences with pin, grinding and / or cutting of small amounts are considered normal erection activities and are included in the duty of the EPC Contractor.

5.20 BASES

Foundation bolt lay-out shall be checked by the OWNER and by EPC contractor using structural steel drawing for arrangement of base plates and foundation drawings before concrete is poured.

Base and bearing plates may be attached or loose as approved on the shop drawings.

Base plates and bearing plates shall be supported and aligned on steel wedges as indicated on drawings.

After the supported members have been plumbed and properly positioned and the anchor nuts tightened, the entire bearing area under the plate shall be filled with a suitable grout.



5.21 CORRECTION OF EROORS

All Fitting-up bolts and drift pins shall not be used to bring improperly fabricated members and parts into place thus causing a strain on bolts in finished work. Drift pins shall not be driven with such force so as to damage adjacent metal. Packing, shimming or wedging will not be permitted to correct faulty work. Minor misfits, which can be remedied by a moderate amount of reaming and slight cutting and chipping, may be corrected by CONSTRUCTION CONTRACTOR when, in the opinion of the COMPANY, it will not be detrimental to the strength or appearance of the structure.

5.22 TOLERANCES

The deviation in overall dimensions, positions, alignments, plumbness and elevations, shall not exceeded the limits specified by AISC "Code of Standard Practice for Steel Buildings and Bridges", chapter "Structural Steel Frame Tolerances", "Erection Tolerances"

Structural elements shall be considered plumb, level and aligned in accordance with the AISC manual. Erection tolerances shall be defined relative to member working points and working lines, which shall be defined as follows:

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- For members other than horizontal members, the member work point shall be the actual center of the member at each end of the shipping piece.
- For horizontal members, the working point shall be the actual centerline of the top flange or top surface at each end.
- The member working line shall be the straight line that connects the member working points.

5.23 DIMENSIONS

All completed work shall be exact to the dimensions required except as officially directed by the Engineer and confirmed in writing. Erection tolerances shall be as permitted in AISC codes of standard practice. Maximum plumb ness variation shall be 25mm. Every piece of materials shall be free from contamination, twist and distortion. Rectification of distortions in welded structures shall be executed in a manner approved by the Engineer.

5.24 DAMAGED TO COATING

Any damage to coatings sustained during erection shall be repaired in the manner directed by OWNER at EPC Contractor's expense. After instruments and personnel required for inspection and tests EPC Contractors shall provide easy and safe access to all parts of the structure.

5.25 STRUCTURAL STABILITY

During erection, temporary bracing and guys shall be used to maintain structural stability as necessary. Temporary erection loads or permanent loads shall not be placed on any incomplete portions of the structure being erected unless it can be demonstrated by analysis that the contemplated action is safe. The structure shall be plumbed, levelled and braced before final bolted or welded connections are made.

5.26 INSPECTION AND TESTING

The COMPANY reserves the right to inspect the materials and fabrication at any time to assure that the materials and workmanship are in accordance with this specification and applicable codes.



Inspection of welding shall be performed in accordance with the Structural Welding Code, AWS D1.1.

A program for inspection and non destructive testing of welds shall be submitted to the COMPANY for approval before the start of the welding operation. The minimum NDT levels will be as follows,

All welds shall be 100% visually inspected the acceptance criteria shall be in accordance with AWS D1.1 Table 6.1

5.27 SAFETY

A safety program shall address safety measures that the erector shall use during steel

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erection work. This program shall comply with the requirements of the contract documents, AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Building and Bridges and OSHA Standard 1926 – Safety and Health Regulations for Construction.

The safety program shall provide a detailed description of prevention of injury to all the personnel affected by the Erection's operations. The safety program shall include an effective system for initial orientation and education in safety and accident prevention, as well as appropriate records to document compliance. As a minimum, the safety program shall place particular emphasis on the following aspects:

- Fall prevention.
- Ground level pre-assembly to minimise elevated erection.
- Hole covers and opening barriers.
- Access control to incomplete areas of erection.
- Lifting plans and hoisting procedures

5.28 BRACING

The frame of steel skeleton building shall be carried up true and plumb within the limits defined in the AISC Code of Standard Practice for Steel Buildings and Bridges. Temporary bracing shall be provided, in accordance with the requirement of the code of standard practice for steel buildings and bridges, wherever necessary to support the loads to which the structure may be subjected, including equipment and the operation of same. Such bracing shall be left in place as long as required for safety.

5.29 WELDED CONNECTIONS

Welding shall conform to AWS D1.1 and AWS A5.1 All welds shall be continuous. Field welding shall not be used unless shown on the shop drawings, erection drawings, or other contract documents.

5.30 FLOOR PLATE AND GRATING

All field-cut floor plate or grating openings requiring toe-plate protection or banding shall be installed as required on the design drawings. Floor and roof deck sheets shall be installed in accordance with the VENDOR's installation instructions and the contract documents.