PIP STS05130
Structural and Miscellaneous
Steel Erection Specification
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

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Drawing
STS05130-01 – Field Located and Field Fabricated Grating Openings
1. Introduction

1.1 Purpose
This Practice provides the requirements for structural and miscellaneous steel erection.

1.2 Scope
This Practice describes the requirements for the receipt, handling, erection, assembly, and field inspection of structural and miscellaneous steel. Structural and miscellaneous steel are as defined in AISC Code of Standard Practice.

2. References
Applicable parts of the following Practices, industry codes and standards, and references shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 Process Industry Practices (PIP)
- PIP STS03600 - Cementitious Grout Specification
- PIP STS03601 - Epoxy Grout Specification
- PIP STS05120 - Structural and Miscellaneous Steel Fabrication Specification

2.2 Industry Codes and Standards
- American Institute of Steel Construction (AISC)
  - AISC 303 - Code of Standard Practice for Steel Buildings and Bridges
  - ANSI/AISC 360 - Specification for Structural Steel Buildings
  - AISC Steel Construction Manual
- American Society of Safety Engineers (ASSE)
- American Welding Society (AWS)
  - AWS D1.1/D1.1M - Structural Welding Code – Steel
- ASTM International (ASTM)
  - ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  - ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric)
  - ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
2.3 Government Regulations

Requirements by state or local agencies that have jurisdiction where the structural steel is to be erected, shall apply.

- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
  - OSHA 29 CFR Part 1910
  - OSHA 29 CFR Part 1926

3. Definitions

contract documents: Any and all documents, including codes, studies, design drawings, specifications, sketches, practices, and data sheets, that the purchaser or engineer of record has transmitted or otherwise communicated, either by incorporation or reference, and made part of the legal contract agreement or purchase order between the purchaser and the erector.

engineer of record: Purchaser’s authorized representative with overall authority and responsibility for the engineering design, quality, and performance of the civil works, structure, foundations, materials, and appurtenances described in the contract documents. The engineer of record shall be licensed as defined by the laws of the locality in which the work is to be constructed, and be qualified to practice in the specialty discipline required for the work described in the contract documents. Also known as structural engineer of record in AISC Code of Standard Practice.

erector: The party responsible for erecting structural and miscellaneous steel in accordance with the contract documents. The term erector shall apply also to the fabricator’s subcontractor(s) and/or vendor(s).

inspector: The party responsible for verifying the quality of all materials, installations, and workmanship furnished by the erector. The inspector shall be qualified by training and experience and hold certifications or documentation of their qualifications. Unless otherwise specified in the contract documents, the inspector shall be retained by the erector.

manufacturer: The party who produces and warrants the performance of the products, materials, and/or items provided in accordance with the contract documents. The products, materials, and/or items are manufactured in a controlled process using standard codes, specifications, tests and possibly include shop drawings to assist in proper application, installation and/or use. The term manufacturer shall apply also to the manufacturer’s subcontractor(s) and/or vendor(s).

owner: The party who owns the facility wherein the structural steel will be used.
professional engineer: An engineer, other than the engineer of record licensed as defined by the laws of the locality in which the steel is to be erected, and qualified to practice in the specialty discipline required for the work described in the contract documents.

purchaser: The party who awards the contract to the erector. The purchaser may be the owner or the owner’s authorized agent.

4. Requirements

4.1 General

4.1.1 Quality Control

4.1.1.1 Unless approved by the engineer of record, erector shall participate in the AISC Certification Program and be designated an AISC Certified Erector, Category ACSE.

4.1.1.2 The erector shall be solely responsible for the quality control of all the erector-supplied materials, installations, and workmanship.

4.1.1.3 A written Quality Control Program and Inspection Procedures document that shall provide details of how compliance with the requirements of this Practice and the shop and erection drawings shall be achieved, shall be provided.

4.1.1.4 A complete up-to-date set of erection drawings at the jobsite shall be maintained.

4.1.1.5 Bolted connections shall be installed and inspected in accordance with the RCSC Specification for Structural Joints Using ASTM A325 and A490 Bolts.

4.1.1.6 Welding procedures and individual welders shall be qualified in accordance with the requirements of AWS D1.1.

4.1.1.7 All welding shall be inspected in accordance with AWS D1.1. Inspectors shall be qualified and certified as AWS Certified Welding Inspectors in accordance with the provisions of AWS D1.1 or AWS QC1 or shall be trained by and working under the supervision of an AWS Certified Welding Inspector.

4.1.1.8 The inspector shall inspect all materials, installations, and workmanship to ensure conformance with all requirements of this Practice and the contract documents.

4.1.1.9 The purchaser shall have the right to inspect all materials, installations, and workmanship and shall have an unrestricted right of access to the work areas.

4.1.1.10 The purchaser may reject any improper, inferior, defective, or unsuitable materials, installations, and workmanship.

4.1.1.11 Rejected materials, installations, and workmanship shall be repaired or replaced in accordance with the purchaser’s instructions at no cost to the purchaser.
4.1.1.12 Inspection tools and tool calibration records for tools used shall be maintained and available for examination by the purchaser.

4.1.2 Submittals

4.1.2.1 The following items shall be submitted to the 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
   f. Assembly lift plan(s) as required by the purchaser or OSHA 29 CFR Part 1926 Subpart R

4.1.2.2 If requested, the following documents shall be submitted to the purchaser for recording purposes:
   a. Quality control inspections and test results
   b. Calibration or recalibration performed on the tools or equipment used during the work

4.1.3 Performance Requirements

4.1.3.1 Safety

1. A written safety program shall be provided that addresses the safety measures that shall be used during steel erection work.

2. The safety program shall be in accordance with the requirements of:
   a. The contract documents
   b. AISC Code of Standard Practice for Structural Steel Buildings and Bridges (AISC 303)
   c. Applicable portions of OSHA 29 CFR Part 1910 and Part 1926
   d. Any other applicable federal, state, or local requirements

4.1.3.2 Assembly Lift Plan

The erector shall be responsible for assuring that all preassemblies that are not specifically shown or noted on the design drawings to be preassembled before lifting shall maintain structural integrity during lifting.

1. A written assembly lift plan, prepared by a professional engineer, shall be provided for assemblies larger than 50 feet (15 meters) in one direction, larger than 2,000 square feet (186 square meters) in the plan area, greater than 50 tons (45 metric tons), or if required by the contract documents.
2. The assembly lift plan shall demonstrate that the proposed lift shall be performed safely and that the assemblies being lifted shall remain free from distortion or undue bending, and maintain structural integrity during the lift.

3. The 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 the cranes, and a description of the rigging to be utilized.

4. Review of the assembly lift plan by the purchaser does not relieve the erector’s responsibility for the safe erection and/or lifting of any component, structural assembly, or any other item.

4.2 Products and Materials

Unless otherwise specified, all materials shall be in accordance with PIP STS05120.

4.3 Execution

4.3.1 Receiving, Inspection, and Storage

4.3.1.1 All materials shall be received, unloaded, stored, and otherwise handled in a manner that prevents distortion, deterioration, damage, or staining.

4.3.1.2 Materials shall be kept free of dirt, grease, and other foreign matter.

4.3.1.3 Unless otherwise specified, all materials shall be inspected 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.

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

4.3.2 Erection

4.3.2.1 Erection of structural steel shall be in accordance with:

a. The drawings and other contract documents

b. AISC Code of Standard Practice for Structural Steel Buildings and Bridges (AISC 303)

c. OSHA 29 CFR Part 1910 and Part 1926

d. Applicable state, municipal, or local regulations or codes

4.3.2.2 Any circumstances discovered that affect progression, performance, or completion of the work activities shall be immediately reported to the purchaser in writing. These may
include, but are not limited to, discrepancies between the erection/shop drawings and the delivered steel members, incorrectly fabricated steel members, or incomplete or unacceptable work of other contractors affecting the work.

4.3.2.3 Any damage caused during erection shall be reported to the purchaser in writing. Corrective measures shall be completed as directed by the purchaser at no cost to the purchaser.

4.3.2.4 Erection of steel joists shall be in accordance with:
   a. The requirements of the Steel Joist Institute (SJI)
   b. The joist manufacturer
   c. OSHA 29 CFR 1926 Subpart R

4.3.2.5 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.

4.3.2.6 Loose timbers, metal sheeting, bolt buckles, tools, debris, and temporary scaffolding shall be kept restrained or removed from work areas.

4.3.2.7 Lifting of painted or galvanized structural members shall be performed with a nonabrasive choker.

4.3.2.8 A daily record, by piece number, of all material erected shall be maintained.

4.3.2.9 Before commencing work, the foundations and other connection points shall be checked to confirm their location, orientation, elevation, and condition.

4.3.2.10 Erection of steel deck shall be in accordance with:
   a. The requirements of the Steel Deck Institute (SDI)
   b. The deck manufacturer
   c. OSHA 29 CFR 1926 Subpart R

4.3.2.11 Where connecting to existing structures, protect existing structure from weather.

4.3.3 Structural Stability

4.3.3.1 During construction, the erector shall be responsible for maintaining the structure in a stable condition; ensuring that no part shall be overstressed during construction activities. It shall be the erector’s responsibility to specify, install and locate all temporary bracing and/or guy cables to maintain the part-assembled structure in a stable condition under a combination of construction and wind loads. This responsibility shall also extend to temporary bracing required to ensure safe and stable conditions of partially completed structural assemblies.
4.3.3.2 The structure shall be plumbed, leveled, and braced before any final bolted or welded connections are made and before grouting of base plates.

4.3.4 Setting Base Plates

4.3.4.1 The top of bearing surfaces and the bottom of base plates shall be cleaned.

4.3.4.2 The column base plates shall be set and shimmed to correct positions, elevations, and locations as shown on the erection drawings.

4.3.4.3 Shims or wedges shall be provided where required.

4.3.4.4 If setting nuts are used, they shall be loosened before grouting.

4.3.4.5 Unless otherwise specified in the contract documents, base plates shall be grouted in accordance with PIP STS03600 or PIP STS03601. Grout shall fill any anchor bolt sleeves and/or shear key openings. Cut off exposed edges of grout at 45 degrees along the edges of base plates after grout has acquired its initial set.

4.3.4.6 If required in the contract documents, anchor bolts shall be tightened to the specified tension.

4.3.4.7 Anchor bolts shall be fully tightened to the specified tension only after the base plates have been grouted and the grout has sufficiently set in accordance with manufacturer’s recommendations.

4.3.5 Bolted Connections

4.3.5.1 If structural joints are made using high-strength bolt assemblies, the materials, methods of installation, tension control, types of wrenches to be used, and inspection methods shall be in accordance with the RCSC Specification for Structural Joints Using ASTM A325 and A490 Bolts and the contract documents.

4.3.5.2 If used, direct tension indicator (DTI) washers shall be installed according to the washer manufacturer’s published specifications.

4.3.5.3 All bolts shall be as noted on the shop drawings, erection drawings, or other contract documents.

4.3.5.4 Mechanically galvanized bolts and nuts shall not be intermixed with hot-dip galvanized nuts and bolts.

4.3.5.5 If ASTM A307 bolt assemblies are used for connecting appurtenances (i.e., handrail assemblies, pipe supports, gates, etc.) to structural steel members, the bolts shall be tightened to a snug-tight condition.

4.3.5.6 ASTM A490/A490M bolts and galvanized ASTM A325/A325M bolts shall not be reused.
4.3.5.7 Bolts that have been pretensioned shall be color coded, die punched, or otherwise marked on the ends indicating that the bolts have been properly tensioned and are ready for inspection.

4.3.6 Welded Connections

4.3.6.1 All welding shall be in accordance with AWS D1.1.

4.3.6.2 Unless approved otherwise by the purchaser, all welds shall be continuous.

4.3.6.3 Minimum fillet weld size shall be AISC minimum 3/16 inch (5 mm), whichever is larger, for structural welds.

4.3.6.4 Seal welds shall be 1/8-inch (3-mm) minimum fillet weld.

4.3.6.5 Welds to connection plates embedded in concrete shall be deposited in a sequence that minimizes distortion of the embedment to plus or minus 1/8 inch (3 mm) of flat or true.

4.3.6.6 If the contract documents require welding to existing facilities that were constructed before 1963 and/or using steel other than ASTM A36, erector shall follow the welding procedure provided by the engineer of record.

4.3.7 Correction of Errors

4.3.7.1 Fit-up bolts and drift pins shall not be used to bring improperly fabricated members and parts into place (springing).

4.3.7.2 Drift pins shall not be driven with such a force as to damage adjacent metal areas.

4.3.7.3 Holes in connections that misfit by more than 1/16 inch (1 mm) shall be corrected as directed by the engineer of record.

4.3.7.4 Enlargement of holes shall be made only when approved by the engineer of record, and made by reaming or drilling only. Flame cutting, burning, gouging, chipping, or drift punching shall not be permitted.

4.3.7.5 Unless approved by the engineer of record, packing, shimming, filling, or wedging shall not be permitted to correct faulty work.

4.3.7.6 One filler plate up to 1/8-inch (3-mm) thickness may be used in spaces between members to be bolted. The engineer of record’s approval shall be required for filler plate requirements greater than 1/8 inch (3 mm).

4.3.8 Steel Joists

4.3.8.1 Field welding or bolting joists to supporting steel framework shall be in accordance with the SJI specifications for the type of joists used, the erection/shop drawings, and other contract documents.

4.3.8.2 Modifications or repairs to steel joists shall not be performed without prior written approval of the engineer of record.
4.3.8.3 Use of power-driven or powder-actuated fasteners in the diagonal and bottom chord members of the joists shall not be permitted.

4.3.9 Floor Plate and Grating

4.3.9.1 All field-cut floor plate or grating openings requiring toe plate protection or banding shall be installed in accordance with detail STS05130-01.

4.3.9.2 The grating and floor plate shall be fastened in accordance with the design drawings. A minimum of four fasteners per panel shall be used.

4.3.10 Metal Decking for Floors and Roofs

4.3.10.1 Floor and roof deck sheets shall be installed in accordance with the deck manufacturer’s installation instructions and the contract documents.

4.3.10.2 All sags, deformations, holes, and other irregularities shall be repaired.

4.3.10.3 If damage has occurred to shop-applied coatings on metal decking, field touch-up shall be in accordance with the decking manufacturer’s recommendations.

4.3.11 Shear Connectors

4.3.11.1 All shear stud attachments shall be welded in strict accordance with the stud manufacturer’s recommendations for welding procedure and welding equipment.

4.3.11.2 If two or more stud welding guns are operated from the same power source, the guns shall be interlocked so that only one gun can be operated at a time to ensure that the power source has fully recovered from making one weld before another weld is started.

4.3.11.3 All ceramic insulators shall be removed from the base of the studs after welding.

4.3.12 Coating Repairs

4.3.12.1 All erection damage to hot-dip galvanized coatings shall be repaired in accordance with PIP STS05120.

4.3.12.2 All erection damage to shop-applied paint coatings shall be repaired in accordance with the purchaser’s coating specification.

4.3.12.3 All galvanized bolt assemblies tightened against shop-applied paint shall be painted.

4.3.12.4 Where twist-off bolt assemblies are used, ends of bolts shall be coated to match the steel coating system.
NON BANDED OPENING, OPENING SHALL BE BANDED IF MORE THAN THREE BEARING BARS OR 10% OF PANEL WIDTH ARE CUT. SEE BANDED OPENING DETAIL BELOW.

WHERE OPENINGS ARE NOT BANDED, BEARING BARS SHALL BE CUT TO PRESENT A NEAT, FINISHED APPEARANCE.

OPENING DIA. = PIPE, INSULATION, OR CONDUIT O.D. + 1 (25)

OPENING DIA. = PIPE, INSULATION, OR CONDUIT O.D. + 4 (100)

1/4" x 5" (6x125) Toe PL BANDED OPENING

PLAN

1/4" x 5" PL OR CARBON STEEL PIPE w/ 1/4" MINIMUM WALL THICK

SECTION A-A

FIELD LOCATED AND FIELD FABRICATED OPENINGS

(For field located openings > 12 (300) dia. or rectangular openings, contact design engineer)

Dimensions are given in feet and/or inches. Metric dimensions in parentheses are in millimeters, unless noted otherwise.