PROCESS INDUSTRY PRACTICES

EDITORIAL REVISION
November 2017

Structural

PIP STF05121
Anchor Fabrication and Installation into Concrete

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.

This Practice is subject to revision at any time.

PUBLISHING HISTORY

August 2003	*Issued*
October 2006	*Technical Correction*
June 2007	*Complete Revision*
November 2017	*Editorial Revision*

Not printed with State funds

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1. Scope

This Practice provides details and requirements for anchor fabrication and installation into concrete. Anchors are anchor rod assemblies that include a rod threaded at the two ends, nuts, washers, and anchor plates and/or sleeves if required. J-bolts and L-bolts are not included. Three standard lengths are shown for each diameter anchor rod in both U.S. Customary units and Metric (SI) units.

This Practice also provides requirements for non-standard anchor rod lengths.

The "Comments" shown in boxes in the Practice are provided for use by the anchor design engineer only.

2. References

Applicable requirements in the following Practices and industry codes and standards 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 STE05121 - *Application of ASCE Anchorage Design for Petrochemical Facilities*
- PIP STS03001 - *Plain and Reinforced Concrete Specification*

2.2 Industry Codes and Standards

- American Society of Testing and Materials (ASTM)
  - ASTM A36/A36M - *Standard Specification for Carbon Structural Steel*
  - ASTM A563 - *Standard Specification for Carbon and Alloy Steel Nuts*
  - ASTM A563M - *Standard Specification for Carbon and Alloy Steel Nuts [Metric]*
  - ASTM F436/F436M - *Standard Specification for Hardened Steel Washers Inch and Metric Dimensions*
  - ASTM F1554 - *Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength*
  - ASTM F2329/ F2329M - *Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners*
- American Society of Mechanical Engineers (ASME)
  - ASME B1.13M - *Metric Screw Threads: M Profile*
  - ASME B18.2.1 - *Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)*
  - ASME B18.2.3.6M - *Metric Heavy Hex Bolts*

3. Definitions

anchor: General term for the anchor bolt or anchor rod assembly. This does not include the concrete and rebar which are parts of the anchorage.

anchor plate: Circular plate bolted at the bottom of an anchor bolt or anchor rod to increase the pull out capacity of the anchor. Typically, this is required to make the anchorage ductile.

anchor rod assembly: Fabricated assembly that includes a rod threaded at the two ends, nuts, washers, and anchor plates if required. J-bolts and L-bolts are not included.

constructor: Party responsible for supplying materials, equipment, tools, supervision, and labor for installation of anchors in accordance with contract documents. The term constructor shall apply also to constructor's subcontractor(s) and vendor(s).

contract documents: Any and all documents, including codes, studies, design drawings, specifications, sketches, practices, and data sheets, that 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 purchaser and fabricator or constructor.

engineer of record: Purchaser's authorized representative with overall authority and responsibility for engineering design, quality, and performance of civil works, structure, foundations, materials, and appurtenances described in contract documents. Engineer of record shall be licensed as defined by 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 contract documents.

fabricator: Party responsible for providing fabricated anchors in accordance with contract documents. The term fabricator shall apply also to fabricator's subcontractor(s) and/or vendor(s).

4. Requirements

4.1 Anchor Dimensional Data and Details

4.1.1 Unless a non-standard anchor rod length is specified on design drawings, the anchors shall be provided in accordance with the dimensional requirements in Table 1 or Table 1M for U.S. Customary or Metric units, respectively.

Comment:

Impractical, design engineer should preferentially specify one of the three standard length anchor rods shown in Table 1 or Table 1M. However, non-standard anchor rod lengths may be specified for the following reasons:

a. A longer than necessary anchor rod length causes the foundation to be deeper than practical.

b. A longer than necessary anchor rod length causes the anchor rod to project into the foundation (i.e., mat), increasing construction costs.

c. A longer anchor rod is needed to properly transfer load to the reinforcing steel.

Comment:

If a non-standard anchor rod length is required, the design engineer should specify the rod length as follows:

a. A whole number of inches for U.S. Customary units or a multiple of 10 mm for Metric units.

b. A minimum of 6 inches (150 mm) shorter or longer than the closest standard length anchor rod.

4.1.2 Anchor and sleeve configuration details shall be in accordance with drawing *PIP STF05121-01*.

4.1.3 Anchor types "A", "B", "C" and "N" shall consist of an anchor rod with a tack-welded nut at bottom and nut(s) and washer at top.

4.1.4 Anchor types "ASL", "BSL", "CSL," and "NSL" shall consist of an anchor rod with a tack-welded nut at bottom and sleeve, nut(s), and washer at top.

4.1.5 Anchor Plates

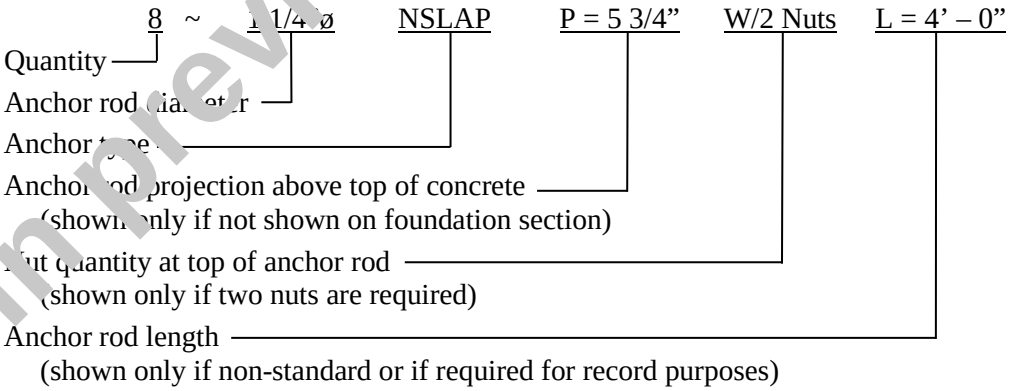
4.1.5.1 If an "AP" is added to the end of the anchor type designation, an anchor plate is required.

4.1.5.2 Anchors having the "AP" suffix shall include components specified in Section 4.1.3 or 4.1.4 of this Practice as applicable, plus an anchor plate and an additional nut above the anchor plate.

4.1.5.3 Example designations for these types of anchors are "AAP" for a type "A" anchor with an anchor plate, and "ASLAP" for a type "ASL" sleeved anchor with an anchor plate.

4.2 Anchor Callout

4.2.1 Anchors with U.S. Customary units are identified in anchor callouts on design drawings as shown in the following example:



Comment:

If required for record purposes, anchor rod lengths of standard length anchors should be specified by the design engineer either in the anchor callout or in notes on design drawings. The design engineer may duplicate Table 1 or Table 1M and drawing *PIP STF05121-01* on design drawings.