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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Fixed Ladders and Cages Design Guide

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   Ladders
1. **Scope**

This Practice provides design guidelines for typical OSHA-regulated fixed ladders and cages as specified and detailed for fabrication in PIP STF05501 for open structures, miscellaneous platforms, and vessels for regular operational access and egress. Typical detail drawings for design are provided that describe ladder and cage details, platform access configurations, support and guide connections, ladder location details, and ladder clearances for side step and step thru ladder types.

*Comment:* As of the effective date of January 17, 2017, this Practice is no longer fully compliant with new OSHA Regulations 29 CFR 1910 Subpart D – Walking-Working Surfaces that were published on November 18, 2016. This Practice will need to be supplemented or modified by the user to be in full compliance with the new OSHA regulations until the complete revision of this Practice incorporating the changes is published by PIP.

2. **References**

Applicable parts of the following Practices, industry codes and standards, and government regulations 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 STC01015 - Structural Design Criteria
- PIP STF05501 - Fixed Ladders and Cages Fabrication Details
- PIP STI03310 - Concrete Typical Details
- PIP STS05120 - Structural and Miscellaneous Steel Fabrication Specification

2.2 **Industry Codes and Standards**

- American Society of Civil Engineers (ASCE)
  - ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures

2.3 **Government Regulations**

The following government document has been used as a reference in the development of this Practice.

- U.S. Department of Labor (DOL) - Occupational Safety and Health Administration (OSHA)
  - Regulations 29 CFR 1910 Subpart D (Walking-Working Surfaces)

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 structure/platform fabricator, ladder fabricator and/or vessel manufacturer

design drawings: Drawings produced by the structure/platform engineer and/or the vessel engineer that show the structure, vessel, platform, and ladder and cage arrangements and details

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.

fabricator shop drawings: Drawings produced by a fabricator that transfer the information from the design drawings and other contract documents into accurate, detailed dimensional information to be used for the fabrication of the ladders, cages and structural steel

ladder fabricator: The party responsible for providing fabricated ladders and cages in accordance with the contract documents. Unless otherwise noted, the term ladder fabricator shall apply also to the ladder fabricator’s subcontractor(s) and/or vendor(s).

owner: The party who has authority through ownership, lease, or other legal agreement over the site, facility, structure, platform, vessel or project wherein the ladders and cages will be used

purchaser: The party who awards the contracts to the structure/platform fabricator, ladder fabricator and/or vessel manufacturer. The purchaser may be the owner or the owner’s authorized agent.

structure/platform engineer: The engineer that performs the design of the structures/platforms, including the ladders and cages that connect to the structures/platforms. The structure/platform engineer may also perform the design of the ladders and cages that connect to vessels if the design of the ladder support and guide connections is validated by a vessel engineer.

structure/platform fabricator: The party responsible for providing fabricated structural and miscellaneous steel in accordance with the contract documents. Unless otherwise noted, the term structure/platform fabricator shall apply also to the structure/platform fabricator’s subcontractor(s) and/or vendor(s).

vessel engineer: The engineer that performs the design of the vessels, including the ladders and cages that connect to the vessels. Alternatively, the vessel engineer may validate the design of the ladder support and guide connections to vessels for ladders and cages that are designed by a structure/platform engineer.

vessel manufacturer: The party responsible for providing manufactured vessels in accordance with the contract documents. Unless otherwise noted, the term vessel manufacturer shall apply also to the vessel manufacturer’s subcontractor(s) and/or vendor(s).
4. Typical Details

Typical details for the design of fixed ladders and cages are shown in the drawings appended to this Practice (i.e., PIP STE05501-01 through PIP STE05501-13).

5. General Design

5.1 Ladder Lengths

5.1.1 In accordance with OSHA Regulations 29 CFR 1910 Subpart D, the maximum length of continuous ladders from grade to elevated platforms allowed is 30 ft (9000 mm) measured from the walking surface at grade to the walking surface at the top platform serviced by the ladder.

5.1.2 In accordance with OSHA Regulations 29 CFR 1910 Subpart D, the maximum length of continuous ladders between elevated platforms allowed is 30 ft (9000 mm) measured from the walking surface at the bottom platform to the walking surface at the top platform serviced by the ladder.

5.2 Platform Access

5.2.1 Intermediate platform access from a continuous ladder is not specifically prohibited by OSHA Regulations 29 CFR 1910 Subpart D, however, it is not generally recommended based on common industry practice. Some owners may prohibit access to intermediate platforms from continuous ladders and may require a break in the ladder at intermediate platforms.

5.2.2 A ladder with side step access at the top platform serviced by the ladder is the preferred configuration by common industry practice. Some owners may prohibit ladders with step through access.

5.2.3 Self-closing double-bar safety gates, in accordance with OSHA Regulations 29 CFR 1910 Subpart D, are required to be provided at the opening in the platform railing for all platforms serviced by the ladder. Some owners may have a preferred manufacturer and type of safety gate to be used for their facility that should be specified in the contract documents accordingly.

5.2.4 The location of the safety gate hinges relative to the ladder orientation as well as the minimum required swing angle of the safety gate should be selected by the structure/platform engineer to provide adequate accessibility between the ladder and platform. The preferred location of the safety gate hinges is at the back of the person using the ladder and should be shown on the design drawings. The minimum required swing angle for safety gates should be 90 degrees, unless a wider swing angle (e.g., 180 degrees) is required for accessibility. The minimum required swing angle of the safety gate should be shown on the design drawings if it is greater than 90 degrees.
5.3 Ladder Cages

5.3.1 In accordance with OSHA Regulations 29 CFR 1910 Subpart D, cages are required on continuous ladders greater than 20 ft (6000 mm) long measured from the walking surface at grade or the bottom platform to the walking surface at the top platform serviced by the ladder.

5.3.2 Some owners specify more stringent criteria requiring cages also for continuous ladders that are 20 ft (6000 mm) long or less.

5.3.3 Cages should be considered for ladders on elevated platforms that are 20 ft (6000 mm) long or less if the bottom of the ladder at the elevated platform is relatively close to the edge of the platform to the side or back of the person using the ladder. In this case, a person using the ladder can potentially fall off the ladder and over the railing at the elevated platform if a cage is not provided.

5.3.4 In accordance with OSHA Regulations 29 CFR 1910 Subpart D, for ladders at elevated platforms that are close to the edge of the platform, cages are required to have vertical bars extending to the top rail of the railing on the platform if the ladder is 4 ft (1200 mm) or less from the edge of the platform to the back of the person using the ladder. However, based on common industry practice, it is recommended that vertical bars extending to the top rail of the railing on the platform be provided if the ladder is 6 ft (1800 mm) or less from the edge of the platform as shown in drawing PIP STE05501-11.

5.3.5 The inside radius for cages shown in details on drawings PIP STE05501-04 and PIP STE05501-05 are in accordance with OSHA Regulations 29 CFR 1910 Subpart D. Some owners specify a larger inside radius for cages than specified by OSHA to accommodate personnel wearing heavy clothing in cold climates and/or air packs in hazardous locations.

5.4 Ladder Supports and Guides

5.4.1 Ladders should be supported at the top and guided at the bottom.

5.4.2 Guides should be provided where required based on the type of rails and the unguided length criteria shown on drawings PIP STE05501-01 and PIP STE05501-03.

5.4.3 Ladder support members, support connectors, and guide connectors to structures/platforms should be located and designed by the structure/platform engineer and shown on the design drawings.

5.4.4 Ladder support members, support connectors, and guide connectors to vessels should be located and designed by the vessel engineer and shown on the design drawings.

5.5 Ladder Rails

5.5.1 Selection of ladder rails by the fabricator should be based on guide locations shown on the design drawings and the unguided length criteria shown on fabrication detail drawing PIP STF05501-01, unless otherwise specified in contract documents.
5.5.2 Guides for ladder rails should be located and designed by the structure/platform engineer and/or vessel engineer based on using bar 2-1/2-inch by 3/8-inch ladder rails wherever feasible. If it is not feasible to provide sufficient guides for bar 2-1/2-inch by 3/8-inch ladder rails, bar 3-inch by 3/8-inch or C3x4.1 ladder rails should be used, in order of preference, based upon the feasibility of providing sufficient guides.

5.6 Ladder Rungs

5.6.1 Ladder rung length of 1 ft 6 inches (460 mm) as specified in PIP STF05501 is based on common industry practice and exceeds the minimum required ladder rung length of 1 ft 4 inches (410 mm) specified in OSHA Regulations 29 CFR 1910 Subpart D. Rung length may be reduced to the minimum required by OSHA or increased at the discretion of the structure/platform engineer, vessel engineer and/or owner. Increased rung lengths may require a larger diameter rung based on design live load as prescribed in Section 5.8 of this Practice.

5.6.2 Ladder rung of 3/4-inch (20 mm) diameter smooth bar as specified in PIP STF05501 is based on common industry practice and minimum requirements in accordance with OSHA Regulations 29 CFR 1910 Subpart D. Ladder rungs specified in PIP STF05501 are designed based on a length of 1 ft 6 inches (460 mm) with an applied design live load as prescribed in Section 5.8 of this Practice.

5.6.3 Ladder rung spacing of 1 ft 0 inch (300 mm) center-to-center as specified in PIP STF05501 is based on common industry practice and maximum allowed ladder rung spacing in accordance with OSHA Regulations 29 CFR 1910 Subpart D. Rung spacing may be reduced at the discretion of the structure/platform engineer, vessel engineer and/or owner.

5.6.4 Ladder rung spacing must be uniform throughout the length of the ladder in accordance with OSHA Regulations 29 CFR 1910 Subpart D. It is not specifically stated in OSHA Regulations 29 CFR 1910 Subpart D whether the spacing between the bottom rung and the base of the ladder must also be uniform with the rung spacing throughout the length of the rest of the ladder.

5.6.5 Ladder pads for ladder bases at grade are designed to have a full 1 ft 0 inch (300 mm) adjustability in height in order to accommodate uniform rung spacing of 1 ft 0 inch (300 mm) throughout the length of the ladder including the bottom rung to the base of the ladder. See Section 5.10 of this Practice for more information about ladder pads.

5.6.6 For ladders with bases at elevated platforms, it is preferred to lay out platform elevations such that the height between platforms serviced by ladders are in even 1 ft 0 inch (300 mm) increments in order to accommodate uniform rung spacing of 1 ft 0 inch (300 mm) throughout the length of the ladder including the bottom rung to the base of the ladder. Where this is not feasible, spacing from the bottom rung to the base of the ladder on the elevated platform may be adjusted in accordance with common industry practice and the criteria shown on drawing PIP STE05501-01.
5.6.7 Some owners specify the use of rungs that are corrugated, knurled, dimpled, or have coatings, caps or other types of treatments that provide slip resistance. Regardless of what is specified, it is important to provide uniformity in the slip-resistance throughout the entire length of the ladder. Regular inspection of ladders and maintenance should be performed to ensure uniform slip-resistance has not been compromised over time due to dirt, wear or damage.

5.7 Ladder Pitch

5.7.1 The preferred pitch of fixed ladders in accordance with *OSHA Regulations 29 CFR 1910 Subpart D* is in the range of 75 degrees and 90 degrees with the horizontal.

5.7.2 Fixed ladders are considered as substandard in accordance with *OSHA Regulations 29 CFR 1910 Subpart D* if they are installed within the pitch range of 60 degrees and 75 degrees with the horizontal. Substandard fixed ladders are permitted only where it is found necessary to meet conditions of installation. This substandard pitch range is considered by OSHA as a critical range to be avoided, if possible.

5.7.3 Fixed ladders having a pitch in excess of 90 degrees with the horizontal are prohibited by *OSHA Regulations 29 CFR 1910 Subpart D*.

5.7.4 Requirements for fixed ladders in *OSHA Regulations 29 CFR 1910 Subpart D* cover only fixed ladders within the pitch range of 60 degrees and 90 degrees with the horizontal.

5.7.5 Details shown in drawings in this Practice and fabrication details shown in drawings in *PIP STF05501* are intended only for ladders with a pitch of 90 degrees with the horizontal. If a ladder is required with a different pitch, additional fabrication details should be provided in an addendum to *PIP STF05501* or shown on design drawings.

5.8 Design Loads

5.8.1 Ladder design for continuous ladders should be based on a 30 ft (9000 mm) maximum length measured from the walking surface at grade or the bottom platform to the walking surface of the top platform serviced by the ladder with a 300 lb (1335 N) concentrated live load at every 10 ft (3000 mm) of ladder length in accordance with *ASCE/SEI 7*.

5.8.2 Individual rungs should be designed with a 300 lb (1335 N) concentrated live load in accordance with *ASCE/SEI 7*.

5.8.3 The following total dead load and live load acting at the center of a continuous ladder should be used for design of ladder support members and support connectors:

a. Dead Load = 900 lbs (4000 N)

b. Live Load = 3 x 300 lbs (1335 N) = 900 lbs (4000 N)

5.8.4 Ladder supports and guides should be designed for ice, wind, and earthquake loads in accordance with *PIP STC01015*. 
5.9 **Allowances for Temperature Variation for Vertical Vessels**

5.9.1 For ladders at vertical vessels, the dimensions shown with an asterisk in details on drawings PIP STE05501-01, PIP STE05501-03, and PIP STE05501-09 are based on the vessel and ladder at ambient temperature.

5.9.2 In order to allow for expansion of a vessel that operates at a temperature above ambient temperature (i.e., hot vessel), the position of the pins or bolts in the slots should be as shown in the Type 2 ladder base detail on drawing PIP STE05501-03 and the guide connection detail on drawing PIP STE05501-09.

5.9.3 In order to allow for contraction of a vessel that operates at a temperature below ambient temperature (i.e., cold vessel), the position of the pins or bolts in the slots shown in the Type 2 ladder base detail on drawing PIP STE05501-03 and the guide connection detail on drawing PIP STE05501-09 should be reversed.

5.9.4 If the fabrication detail drawings included in PIP STF05501 are to be used for vessels operating below ambient temperature, an addendum to PIP STF05501 should be prepared to reverse the position of the pins or bolts in the slots shown in the appropriate details on fabrication detail drawings PIP STF05501-03 and PIP STF05501-09.

5.10 **Ladder Pads**

5.10.1 Ladders designed in accordance with this Practice that have connections at the base are intended to be used with ladder pad details in accordance with PIP STI03310.

5.10.2 Ladder pads detailed in PIP STI03310 are based on a ladder pad height between 0 inch (0 mm) minimum and 1 ft (300 mm) maximum.

6. **Contract Documents**

6.1 The following information should be shown on the design drawings by the structure/platform engineer and/or vessel engineer as applicable:

a. Location and orientation of ladder and cage including the centerline of rungs in the plane of the ladder and the centerline of the ladder and cage perpendicular to the plane of the ladder

b. Location of safety gate hinges relative to the orientation of ladder

c. Selection of Type 1 ladder base (preferred – no connection at base) or Type 2 ladder base (with connection at base) for ladders at vertical vessels. See ladder base details on drawing PIP STE05501-03.

d. Top of bottom rung elevation for ladders at vertical vessels with Type 1 ladder base. See ladder base details on drawing PIP STE05501-03.

e. Bottom of ladder elevation for ladders at structures/platforms and horizontal vessels, and ladders at vertical vessels with Type 2 ladder base. See ladder base details on drawings PIP STE05501-02 and PIP STE05501-03.

f. Top of platform elevations (walking surface) for platforms serviced by ladder
g. Locations and details for ladder support members and support connectors to structures/platforms or vessels
h. Locations and details for ladder guide connectors to structures/platforms or vessels
i. Whether a cage is required for the ladder
j. Bottom of cage elevation if a cage is required

6.2 The following information should be included in an addendum to PIP STF05501 or specified elsewhere in the contract documents if applicable:

a. Ladder and cage details for access to intermediate landings from continuous ladders
b. Inside radius of cages and associated details if greater than specified by OSHA Regulations 29 CFR 1910 Subpart D
c. Alternate slotted ladder base and guide connection details for ladders on vertical vessels that operate at a temperature below ambient temperature (i.e., cold vessels)
d. Design loads for support members, support connectors, and guide connectors to structures/platforms if connection design is in the scope of services provided by the structure/platform fabricator
e. Ladder rail selection criteria if different than specified in PIP STF05501
f. Rung length, diameter, and associated details if different than 1 ft 6 inches (460 mm) long 3/4 inch (20 mm) smooth bar
g. Ladder rung spacing if less than 1 ft 0 inch (300 mm)
h. Requirements for slip-resistant rungs
i. Details for ladders and cages with a pitch less than 90 degrees with the horizontal
j. Structural steel material if different than specified in PIP STF05501
k. Metric equivalents for plates, bars and structural shapes
l. Alternative or additional coatings for ladder and cage assemblies (e.g., safety yellow paint) if different from requirements specified in PIP STF05501
m. Specific manufacturer and type of safety gates to be used if owner has a preference
n. Minimum required swing angle of safety gates if greater than 90 degrees
o. Any other requirements that are different or in addition to PIP STF05501

7. Fabricator Shop Drawings Review

Fabricator shop drawings should be reviewed by the structure/platform engineer and/or vessel engineer as applicable to ensure the drawings are in accordance with PIP STS05120, PIP STF05501, relevant design drawings, and other contract documents as applicable. Drawing reviews should include the following checks:

a. Latest revisions of the structure/platform and/or vessel design drawings, and ladder and cage design drawings have been used as applicable
b. Fabricator shop drawings are in accordance with material specifications, dimensions, fabrication details, and other requirements as specified in *PIP STS05120* and *PIP STF05501*

c. Ladder and cage orientations and locations are correct

d. Top of bottom rung elevations for ladders at vertical vessels with Type 1 ladder base (no connection at base) are correct and ladder base is detailed in accordance with fabrication detail drawing *PIP STF05501-03*

e. Bottom of ladder elevations for ladders at structures/platforms and horizontal vessels, and ladders at vertical vessels with Type 2 ladder base (with connection at base) are correct and ladder base is detailed in accordance with fabrication detail drawings *PIP STF05501-02* and *PIP STF05501-03*

f. Top of platform elevations are correct and even with top of ladder rungs at platforms

g. Ladder rail sizes are selected correctly in accordance with guide locations shown on design drawings and unguided length criteria shown on fabrication detail drawing *PIP STF05501-01*

h. Plates connecting ladders to support connectors on structures/platforms and/or vessels at the top of the ladders are located and detailed correctly in accordance with design drawings and fabrication detail drawings *PIP STF05501-06* through *PIP STF05501-08*

i. Slotted plates connecting ladders to guide connectors on structures/platforms and/or vessels are located and detailed correctly in accordance with design drawings and fabrication detail drawings *PIP STF05501-09* and *PIP STF05501-10*

j. Support members, support connectors, and guide connectors to structures/platforms and/or vessels are located and detailed correctly in accordance with design drawings

k. Support members, support connectors, and guide connectors to structures/platforms are designed correctly by the structure/platform fabricator if the connection design is in the scope of services provided by the structure/platform fabricator

l. Cages are provided where specified

m. Bottom of cage elevations are correct

n. Vertical bars of cages are extended to the top rail of the railing on the platform if required for ladders at elevated platforms

o. Galvanizing requirements are shown correctly

p. Additional coating requirements, if required, are shown correctly

q. Self-closing double-bar safety gates, in accordance with *OSHA Regulations 29 CFR 1910 Subpart D* and owner preferences, are provided at the opening in the platform railing for all platforms serviced by the ladders. Location of the safety gate hinges relative to the orientation of ladders as well as the swing angle of the safety gates are in accordance with design drawings.

r. Sufficient quantities of specified bolts required for erection of ladder and cage assemblies are indicated to be provided by ladder fabricator
Comment: As of the effective date of January 17, 2017, this Practice is no longer fully compliant with new OSHA Regulations 29 CFR 1910 Subpart D - Walking-Working Surfaces that were published on November 18, 2016. This Practice will need to be supplemented or modified by the user to be in full compliance with the new OSHA regulations until the complete revision of this Practice incorporating the changes is published by PIP.
LADDER BASE AT STRUCTURE/PLATFORM OR HORIZONTAL VESSEL

LADDER BASE CONNECTION NOTES:

1. CONNECTION TO STEEL OR GRATING AT ELEVATED PLATFORM:
   LADDER FABRICATOR TO PROVIDE 2~CONNECTION BOLT ASSEMBLIES
   AT THE BASE OF EACH LADDER.
   EACH CONNECTION BOLT ASSEMBLY CONSISTS OF
   1~ASTM A307 5/8" (16) DIAMETER BOLT, 1~NUT, 1~WASHER,
   AND 1~PLATE 2 1/2" x 2 1/2" x 1/4".

2. CONNECTION TO CONCRETE AT GRADE:
   LADDER PAD INSTALLER TO PROVIDE LADDER PAD
   AND 5/8" (16) DIAMETER ADHESIVE ANCHORS.
   (SEE PIP ST033310 FOR LADDER PAD DETAILS)

DIMENSIONS ARE GIVEN IN FEET AND/OR INCHES. METRIC DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.

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**NOTE:**

SEE PIP STE05501, SECTION 5.9 FOR VESSEL OPERATING PARAMETERS THAT THESE DIMENSIONS ARE BASED ON.

See PIP STE05501-01 for other ladder details.

**TYPE 1 (PREFERRED — NO CONNECTION AT BASE)**

**SIDE ELEVATION**

- 3/8" BAR (TYP) (460) 1"-6" 3/16" WEB (TYP) 2" (50) 2" (50) 1-1/2" (38)
- 1 5/8" (41) LONG ANGLE AT CHANNEL RAIL (TYP)
- 2 1/2" (63) LONG ANGLE AT BAR RAIL (TYP)
- 11/16" (18) DIA HOLE (TYP)
- 3/16" (5) (TYP) L 6 x 3 1/2 x 3/8 WITH 11/16" (18) DIA X 4" (100) LONG SLOTTED HOLE (TYP)

**AT BAR RAIL**

- 3/4" (19) (TYP) ANGLE BASE PARTIALLY SHOWN FOR CLARITY
- 11/16" (18) DIA HOLE IN RAIL FOR 5/8" (16) DIAMETER SMOOTH ROD (TYP)
- 3/4" (19) (TYP) BOTTOM OF LADDER ELEVATION (TO BE SHOWN ON DESIGN DRAWING)

**AT CHANNEL RAIL**

- 3/4" (19) (TYP) ANGLE BASE PARTIALLY SHOWN FOR CLARITY
- 11/16" (18) DIA HOLE IN RAIL FOR 5/8" (16) DIAMETER SMOOTH ROD (TYP)
- 3/4" (19) (TYP) BOTTOM OF LADDER ELEVATION (TO BE SHOWN ON DESIGN DRAWING)

**LADDER BASE CONNECTION NOTES:**

1. CONNECTION TO STEEL OR GRATING AT ELEVATED PLATFORM: LADDER FABRICATOR TO PROVIDE 2 CONNECTION BOLT ASSEMBLIES AT THE BASE OF EACH LADDER.
   
   EACH CONNECTION BOLT ASSEMBLY CONSISTS OF 1 ASTM A307 5/8" (16) DIAMETER BOLT, 1 NUT, 1 WASHER, AND 1 PLATE 2 1/2" x 2 1/2" x 1/4".

2. CONNECTION TO CONCRETE AT GRADE: LADDER PAD INSTALLER TO PROVIDE LADDER PAD AND 5/8" (16) DIAMETER ADHESIVE ANCHORS.

   (SEE PIP STI03310 FOR LADDER PAD DETAILS)

**TYPE 2 (ALTERNATE — WITH CONNECTION AT BASE)**

**FRONT ELEVATION**

LADDER BASE AT VERTICAL VESSEL

DIMENSIONS ARE GIVEN IN FEET AND/OR INCHES. METRIC DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.
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**Elevation**

SIDES STEP LADDER SUPPORT CONNECTION TO VERTICAL VESSEL

(ONE SET PER LADDER)

DIMENSIONS ARE GIVEN IN FEET AND/OR INCHES. METRIC DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.
Fixed Ladders and Cages
Side Step Ladder Support
Connection to Structure/Platform

Support Beam to Structure/Platform to be designed by Structure/Platform Engineer and shown on design drawing (fabricated by Structure/Platform Fabricator)

Support Connectors to Structure/Platform to be designed by Structure/Platform Engineer and shown on design drawing (fabricated by Structure/Platform Fabricator)

Inside Face of Support Connectors to Structure/Platform

Support Connectors to Structure/Platform to be designed by Structure/Platform Engineer and shown on design drawing (fabricated by Structure/Platform Fabricator)

7" (180) min to nearest obstruction behind ladder rungs (location to be shown on design drawing)

Ladder (location to be shown on design drawing)

Plan
Side Step Ladder Support
Connection to Structure/Platform

Support Connectors to Structure/Platform to be designed by Structure/Platform Engineer and shown on design drawing (fabricated by Structure/Platform Fabricator)

2-5/8" (16) Dia ASTM A307 bolts (by ladder fabricator) (install with bolt head to inside of ladder)

2-1/2" C3 rail

Plate and support connector (location to be shown on design drawing)

Structure/Platform

5" (130) unless otherwise noted on design drawing

Ladder rail

3/8" x 6" outside each ladder rail for bar rail (by ladder fabricator) (see detail this drawing for plate connection to channel rail)

Detail
Plate Connection to Channel Rail

3/8"

3/8" rungs

C3 rail

Elevation
Side Step Ladder Support
Connection to Structure/Platform

(One set per ladder)

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

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NOTE:
SAFETY GATE NOT SHOWN FOR CLARITY

NOTE:
SUPPORT CONNECTORS TO STRUCTURE/PLATFORM TO BE DESIGNED BY STRUCTURE/PLATFORM ENGINEER TO AVOID INTERFERENCE WITH RAILING POST ATTACHMENT (SEE PIP ST05521)

PLAN
STEP THRU LADDER SUPPORT CONNECTION TO STRUCTURE/PLATFORM

ELEVATION
STEP THRU LADDER SUPPORT CONNECTION TO STRUCTURE/PLATFORM
(ONE SET PER LADDER)

DIMENSIONS ARE GIVEN IN FEET AND OR INCHES. METRIC DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.

LEGEND NOTES
A SUPPORT CONNECTORS TO STRUCTURE/PLATFORM TO BE DESIGNED BY STRUCTURE/PLATFORM ENGINEER AND SHOWN ON DESIGN DRAWING (FABRICATED BY STRUCTURE/PLATFORM FABRICATOR)
B 3/8" X 6" OUTSIDE EACH LADDER RAIL FOR BAR RAIL (BY LADDER FABRICATOR) (SEE DETAIL THIS DRAWING FOR PLATE CONNECTION TO CHANNEL RAIL)
C PLATE AND SUPPORT CONNECTOR (LOCATION TO BE SHOWN ON DESIGN DRAWING)
D 2-5/8" (16) DIA ASTM A307 BOLTS (BY LADDER FABRICATOR) (INSTALL WITH BOLT HEAD TO INSIDE OF LADDER)

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PROCESS INDUSTRY PRACTICES
ENGINEERING GUIDE
FIXED LADDERS AND CAGES
LADDER GUIDE
CONNECTION TO VERTICAL VESSEL

1" - 1 1/2"
(500)
9 3/4"
(250)

INSIDE FACE OF
GUIDE CONNECTORS
TO VESSEL

GUIDE CONNECTORS TO VESSEL
TO BE DESIGNED BY VESSEL ENGINEER
AND SHOWN ON DESIGN DRAWING
(FABRICATED BY VESSEL MANUFACTURER)

2 7" (180) MIN
TO NEAREST OBSTRUCTION
BEHIND LADDER
(INCLUDING INSULATION)

RUNS
,LOCATION TO
BE SHOWN ON
DESIGN DRAWING

SEE DETAIL THIS
DRAWING FOR PLATE
CONNECTION TO
CHANNEL RAIL

PLAN
LADDER GUIDE
CONNECTION TO VERTICAL VESSEL

BOLT HOLE AND GUIDE CONNECTOR
,LOCATION TO BE SHOWN
ON DESIGN DRAWING

GUIDE CONNECTORS TO VESSEL TO
BE DESIGNED BY VESSEL ENGINEER
AND SHOWN ON DESIGN DRAWING
(FABRICATED BY VESSEL MANUFACTURER)

VESSEL

1 1/2" (38)

1 1/16" (18) DIA HOLE IN GUIDE CONNECTOR TO VESSEL AND
1 1/16" (18) DIA x 4" (100) LONG SLOTTED HOLE IN
LADDER CONNECTION PLATE FOR 5/8" (16) DIA
ASTM A307 BOLT WITH 2 NUTS (BY LADDER FABRICATOR)
(INSTALL WITH BOLT HEAD TO INSIDE OF LADDER)
BOLTS SHALL BE HAND TIGHTENED.
NUTS SHALL BE JAMMED TO PROVIDE A 1/16" (2) CLEARANCE
BETWEEN THE NUT AND THE GUIDE CONNECTOR MEMBER

NOTE:
SEE PIP STE05501,
SECTION 5.9 FOR
VESSEL OPERATING
PARAMETERS THAT
THIS DIMENSION IS
BASED ON

5" (130)
UNLESS OTHERWISE
NOTED ON
DESIGN DRAWING

ELEVATION
LADDER GUIDE
CONNECTION TO VERTICAL VESSEL

DIMENSIONS ARE GIVEN IN FEET AND/OR INCHES. METRIC DIMENSIONS
IN PARENTHESES ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.
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**Fixed Ladders and Cages**

**Ladder Cage at Elevated Platform**

**STANDARD FLARE CAGE WITH 3 ~ EXTENDED VERTICAL BARS AT THE BACK TO BE PROVIDED**

2'–6" (770) MIN

**STANDARD FLARE CAGE WITHOUT EXTENDED VERTICAL BARS AT THE BACK TO BE PROVIDED IF CAGE IS SHOWN ON DESIGN DRAWING**

UP TO 6'–0" (1800) *

OVER 6'–0" (1800) *

**NOTE:**

See PIP STE05501, SECTION 5.3.4

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**PLAN**

**LADDER CAGE AT ELEVATED PLATFORM**

**SECTION A–A**

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

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MINIMUM CLEARANCES
FOR LADDER WELLS
AND LADDERS THROUGH PLATFORMS
FOR LADDERS W/O CAGES

WHERE DISTANCE TO ANY
UNAVOIDABLE OBSTRUCTION
(INCLUDING INSULATION) IS
LESS THAN 7" (180)

MINIMUM CLEARANCES FOR
UNAVOIDABLE OBSTRUCTIONS
BEHIND FIXED LADDERS

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