

Engineering Standard

SAES-B-054

15 March 2006

Access, Egress, and Materials
Handling for Plant Facilities

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1 Scope

This Standard defines the minimum mandatory requirements governing the design and installation of access, egress, and materials handling requirements for maintenance and operation of onshore and offshore plant facilities. In case of requirements in SAES-B-009 which differ from those in SAES-B-054, SAES-B-009 shall govern for offshore facilities.

This Standard does not apply to facilities covered by the Saudi Aramco Building Code, SAES-M-100.

2 Conflicts and Deviations

- 2.1 Any conflicts between this Standard and other applicable Saudi Aramco Engineering Standards (SAESs), Saudi Aramco Materials System Specifications (SAMSSs), Saudi Aramco Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Loss Prevention Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this Standard in writing to the Company or Buyer Representative, who shall follow internal company procedure SAEP-302 and forward such requests to the Manager, Loss Prevention Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by the Standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

<i>SAEP-302</i>	<i>Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement</i>
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Saudi Aramco Engineering Standards

<i>SAES-B-005</i>	<i>Spacing and Diking for Atmospheric and Low-Pressure Tanks</i>
<i>SAES-B-009</i>	<i>Fire Protection and Safety Requirements for Offshore Production Facilities</i>

<i>SAES-B-055</i>	<i>Plant Layout</i>
<i>SAES-D-100</i>	<i>Atmospheric and Low-Pressure Tanks</i>
<i>SAES-D-109</i>	<i>Design of Small Tanks</i>
<i>SAES-H-101</i>	<i>Approved Protective Coating Systems</i>
<i>SAES-M-001</i>	<i>Structural Design Criteria for Non-Building Structures</i>
<i>SAES-M-005</i>	<i>Design and Construction of Fixed Offshore Platforms</i>
<i>SAES-M-100</i>	<i>Saudi Aramco Building Code</i>
<i>SAES-P-123</i>	<i>Lighting</i>

Saudi Aramco Materials System Specifications

<i>12-SAMSS-007</i>	<i>Fabrication of Structural and Miscellaneous Steel</i>
<i>32-SAMSS-005</i>	<i>Atmospheric Steel Tanks</i>
<i>32-SAMSS-006</i>	<i>Large, Welded Low-Pressure Tanks</i>

Saudi Aramco Standard Drawings

<i>AB-036106</i>	<i>Assembly and Details of Type "A" Stairs for Walkways and Platforms</i>
<i>AC-036198</i>	<i>Assembly and Details of Type "B" Stairs</i>
<i>AD-036683</i>	<i>Roads and Earthen Firewalls in Tank Farms, Details</i>

3.2 Industry Codes and Standards

American National Standards Institute

<i>ANSI A14.1</i>	<i>Ladders, Portable Wood, Safety Requirements</i>
<i>ANSI A14.2</i>	<i>Ladders, Portable Metal, Safety Requirements</i>
<i>ANSI A14.3</i>	<i>Ladders, Fixed, Safety Requirements</i>
<i>ANSI A1264.1</i>	<i>Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems</i>

Process Industry Practices

<i>PIP STF05501</i>	<i>Fixed Ladders and Cages</i>
<i>PIP STF05520</i>	<i>Pipe Railing for Walking and Working Surface Details</i>

4 Access and Egress Requirements

4.1 General

Plant facilities shall be provided with acceptable access and egress for personnel, materials, and equipment by using accessways, ladders, roads, stairways, stiles, and walking/working surfaces (decks, floors, grade, platforms, ramps, runways, and walkways) based on the requirements in this Standard.

4.2 Access Requirements for Equipment Regularly Operated or Maintained or Operated in an Emergency

For equipment regularly operated or maintained or operated in an emergency, such as valve hand wheels, instrumentation, controls, and their associated manifolds, the distance, if located outside the handrails, from a fixed walking/working surface to the operating point shall be between 500 mm and 1500 mm vertically and a maximum of 510 mm horizontally. It shall be located away from top rail, midrails and supports to allow access.

Commentary Note:

Access is also acceptable for instrumentation, controls, and associated manifolds if the distance from the outside of a fixed ladder or fixed stairs to the operating point does not exceed 510 mm.

4.3 Access Requirements for Vessel Openings

4.3.1 For vessel openings, such as manholes and inspection openings, the vertical distance from grade to the lower inside surface of the opening shall not exceed 3 m.

4.3.2 Where access is needed at elevations greater than 3 m above grade, it is also acceptable for manholes and inspection openings to be above a fixed, elevated walking/working surface so that the lower inside horizontal surface of the manhole does not exceed 760 mm vertically above that walking/working surface.

4.3.3 If access to manholes is from a fixed, elevated walking/working surface, this surface shall be under the manhole's flange to prevent personnel from falling through an opening as they exit the manhole.

4.4 Access Requirements for Equipment Requiring Access During Maintenance Only

For equipment such as blinds, heat exchanger tube sheets, and heat exchanger bonnets that require access during maintenance, fixed walking/working surfaces shall be provided such that maintenance work can be safely performed from these surfaces or from one stage of scaffolding from these surfaces.

4.5 Access Requirements for Valves Not Regularly Operated

Valves not regularly operated shall be accessed from portable platforms, portable stairs, portable ladders, or temporary scaffolding if access from fixed walking/working surfaces or fixed stairs is not provided.

These valves consist of the following:

- a) Valves used exclusively for tie-in purposes.
- b) The first block valve in a line to a utility header.
- c) Vents and drains used for steam-out, purging, or pressure testing of piping.
- d) Inlet/outlet block valves on relief valves and the relief valves shall be readily accessible, per the requirements in paragraph 4.2.

4.6 Requirements for Primary and Secondary Access/Egress to Elevated Work Areas

4.6.1 If the frequency of use is daily, a fixed stairway shall be provided as primary access to and egress from each elevated working area. If the frequency of use is less than daily, a stairway shall be provided if materials, tools or other equipment normally must be carried for operating or maintenance, or if there is a potential for exposure to injurious chemicals or material at the elevated working surface.

4.6.2 A secondary means of egress (which may be either a fixed ladder or a fixed stairway) shall be provided for each elevated working surface if:

- a) The location is 3 m or more above grade, floor, sea, or deck level and has 19 m² or more area, or if:
 - b) There is a potential spill or fire hazard or injurious chemical exposure that could block access to an exit.
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This secondary means of egress shall not be more than 25 m horizontally from an area where operating or maintenance personnel may be working, and shall be located such that an alternative route of escape to a place of safety is provided. Exits to safety from such areas shall be located as far from each other as is practicable.

4.6.3 An escape path of solid steel flooring at least 760 mm wide shall be provided where the escape route would otherwise traverse open grating with fire hazardous equipment below. Egress (escape) routes shall not traverse open grating over fire-hazardous equipment. All edges must be installed so there is no trip hazard.

4.6.4 Dead ends in elevated work areas shall not be over 7.6 m long.

4.7 Access/Egress Clearances for Personnel

4.7.1 Minimum clear width of walking/surfaces, stairways and stiles shall be 760 mm.

Exceptions:

a) *The minimum clear width for tank stairways shall be per Section 7, Paragraph (6.3).*

b) *The minimum clear width shall be 910 mm where working area is needed such as in the front of a manhole for servicing trays, the end of a heat exchanger for servicing the bonnet, channel, and tube bundle, or around rotating equipment.*

c) *The minimum clear width of aisles shall be 1020 mm. (An aisle is personnel walking space around equipment at grade level.)*

4.7.2 The minimum headroom above walking/working surfaces shall be 2030 mm, measured to the lowest point of an overhead obstacle.

4.7.3 The minimum vertical clearance under vertical furnaces shall be 2030 mm.

4.7.4 The vertical clearance above any stair tread to an overhead obstruction shall be at least 2030 mm measured from the leading edge of the tread.

4.7.5 Refer to SAES-B-055 for clearances needed for fire fighting and other emergency equipment.

4.8 Personnel Ramps

Personnel ramps shall be designed per SAES-M-001 and SAES-M-100 and shall be constructed of steel per 12-SAMSS-007.

Exception:

The slip resistant walking surface shall not be steel.

4.9 Grating, Tread, and Surface Treatments

4.9.1 Stair treads shall be of a steel grating type with an abrasive nosing.

Exception:

Alternative materials allowed by Section 7, paragraph 6.15.

4.9.2 Nongrating walking surfaces that could be exposed to a slippery fluid, such as water or oil, shall have a nonskid surface, i.e., anti-skid paint on steel plate (see SAES-H-101, APCS-12).

4.9.3 Steel plate with diamond or other patterns may be provided but does not cancel the requirement for anti-skid paint.

Commentary Note:

Past versions of this Standard prohibited diamond-pattern ("checker-plate") steel platform plating, for the reason that such plating has not found to have substantially better skid resistance than ordinary nonpattern steel plating. In many cases, Saudi Aramco projects have paid a premium for diamond-pattern plating, only to find that they still have to paint it with anti-skid paint. It seems that some facilities prefer diamond-pattern plating regardless, or prefer to match existing construction. In order to avoid the necessity of a waiver, the prohibition against diamond-pattern plating has been removed, but the anti-skid paint requirement still stands.

4.9.4 Deck plates and grating around equipment such as pumps, drivers, and compressors shall be removable to allow easy access for maintenance. All removable deck plates and grating shall be held in place with bolts and/or clips.

4.9.5 Refer to the following documents for other specific requirements:

SAES-D-100 Atmospheric and Low Pressure Tanks

SAES-D-109 Design of Small Tanks

SAES-M-005 Fixed Offshore Platforms

12-SAMSS-007 Steel Structures

4.10 Illumination and Access to Lighting

4.10.1 Illumination shall be per SAES-P-123.

4.10.2 Access to lighting fixtures shall meet SAES-P-123.

4.11 Access/Egress for Offshore Facilities via Boat, Life Raft, Helicopter, and Escape Capsule

Refer to SAES-M-005 and SAES-B-009 for special offshore access/egress requirements related to boats, boat landings, life rafts, helicopters and escape capsules.

4.12 Roads, Accessways, and Gates

4.12.1 Refer to SAES-B-055 for definitions of roads and accessways, their sizing, and other requirements.

4.12.2 Onshore plants shall be provided with at least a secondary access road on opposite sides of the plant.

4.12.3 A primary access road to a plant shall not be located in a plant's surface drainage pattern, and shall be located on the plant's upwind side if practical.

4.12.4 Diked areas around tankage or pressure vessels shall be provided at least one access road in accordance with SAES-B-005 and Standard Drawing AD-036683.

4.12.5 Normal vehicle traffic to the parking lot of plant facilities and to primary access gates shall not pass under power lines where practical.

4.13 Access to Tankage Sites

4.13.1 A 6 m wide earthen ramp shall be provided over tank dikes for access of mobile equipment during tank testing and inspection.

4.13.2 Each tank diked area shall be provided with a total of two stiles located on opposite sides of the diked area if the dike is over 910 mm high.

These stiles shall be located as near as practical to fire hydrants.

4.14 Floating Roof Storage Tank Access

Access to the floating roof from the wind girder platform shall be provided by an inclined stairway with self-leveling tread. Inclined ladders with rungs are prohibited.

4.15 Portable Ladders

Portable ladders shall be per ANSI A14.1 or ANSI A14.2.

5 Materials Handling for Operations

5.1 Materials Handling Equipment

Materials handling equipment such as davits, trolley beams, and ramps shall be provided as appropriate to handle materials such as chemicals and catalysts for plant operation.

5.2 Materials Storage Space

Storage space shall be provided as appropriate for materials such as chemicals and catalysts.

6 Materials Handling Equipment

6.1 Mobile Equipment Access

6.1.2 Accessways for mobile equipment shall be provided to handle equipment during maintenance and for fire fighting per SAES-B-055.

6.1.3 Drop zones for materials handling equipment shall be provided at appropriate elevations for materials such as rotating equipment, piping, and column internals. These drop zones shall be accessible to mobile equipment.

6.2 Trolley Beams, Cranes, and Davits

6.2.1 Trolley beams, cranes, and davits shall be provided as appropriate to service equipment such as pumps, motors, scraper launchers, compressors, turbines, relief valves (nominal 100 mm and larger), and manhole covers. These lifting facilities shall extend beyond equipment foundations into drop zones accessible to mobile equipment.

6.2.2 Trolley beams or davits shall be provided at the top of columns with internals and/or with flanges over 100 mm (nominal) or weighing over 36 kg.

6.2.3 Manhole covers shall be hinged or equipped with davits. Manhole covers on the underside of horizontal pressure vessels shall be counter-balanced if their weight is over 36 kg.

6.2.4 The following PIP Standard Drawings, or their equivalents, approved by the project engineer, shall be followed for davits as appropriate for their application:

PIP VEFV11009 Vessels / S&T Heat Exchanger Standard Details

6.3 Removable Sections of Floors, Platforms, Walls and Roofs

Removable sections in floors, platforms, walls, and roofs shall be provided as appropriate for removing and lowering machinery components to grade level for further handling by mobile equipment. However, built-in equipment handling facilities shall be provided where practical.

7 Modifications to ANSI A1264.1

The following paragraph numbers and drawing references refer to ANSI A1264.1, which is a part of this Standard. The text in each paragraph below is an addition, modification, exception, or deletion to the requirements of ANSI A1264.1. Paragraphs not mentioned below are accepted in their entirety.

(5.5) (Revision) Stair-Railing System

Change the vertical height of the stair-railing system from the range shown. The paragraph shall then be as follows:

"A stair-railing system shall meet dimensions shown in PIP STF05520."

(5.8) (Revision) Handrail

Change the height of the handrail from the range shown. The last sentence of the paragraph shall then be as follows:

"The height of handrails shall meet the details as shown in PIP STF05520."

(6.3) (Revision) Clearance

Increase the clearance (width) for stairs to 760 mm and add tank stairs' requirements. The paragraph shall then be as follows:

"Fixed stairs shall have a minimum clear width of 760 mm except stairs on tanks shall have a minimum clear width of 710 mm."

(6.4) (Revision) Slope

Revise the paragraph to be as follows:

"Fixed stairs shall be installed at an angle of 30 to 45 degrees to the horizontal. Wherever practical, fixed stairs shall be installed at an angle of 37 degrees to the horizontal with a rise of 190 mm and a tread run of 254 mm."

(6.9) (Revision) Long Flights of Stairs

Add landing requirements. The paragraph shall be as follows:

"A stairway landing shall be provided for every 5 m of vertical rise of a stairway wherever practical."

(6.12) (Revision) Vertical Clearance

Revise the vertical clearance. The paragraph shall be as follows:

"Vertical clearance above any stair tread to an overhead obstruction shall be at least 2030 mm measured from the leading edge of the tread."

(6.14) (Addition) Open Grating for Outdoors

Add the following paragraph:

"Open grating type treads shall be provided on outdoor stairs. Refer to SAES-M-005 for special requirements for treads on offshore platforms."

(6.15) (Addition) Materials of Construction

"Fixed stairs, and their appurtenances, guard rails, handrails, stair rails, and toe boards, shall be constructed of steel per 12-SAMSS-007 and SAES-M-001, or 32-SAMSS-005 or 32-SAMSS-006, as applicable.

Exception:

Wood or other suitable material may be used for unusually corrosive environments such as cooling towers, if approved by the manager of the proponent operating department with the concurrence of the Saudi Aramco Chief Fire Prevention Engineer, Dhahran.

(6.16) (Addition) Standard Drawings

Add the following:

"Stairs, guard rails, handrails, stair rails, and toe boards shall be per figures in PIP STF05520.

AB-036106 Type A, Stairs for Platforms

AC-036198 Type B, Stairs for Platforms

(6.17) (Addition) Wind girders for open top floating roof tanks shall be provided with handrails.

(6.18) (Addition) The bending radius of the top handrail shall be 190 mm. Mitered construction shall not be used in place of bending handrails.

Exception:

Removable railing section as shown in PIP STF05520.

- (6.19) (Addition) The handrail shall offer no obstructions to a smooth, continuous surface along both sides and the top.
- (6.20) (Addition) Provide handrails on all walkways and platforms over 1 m high.
- (6.21) (Addition) Provide toeboards/toeplates on all walkways and platforms 2 m high and over.
- (6.22) (Addition) Wherever toeboards/toeplates are required on platforms or landings, the toeboard/toeplate shall be extended across the first riser at bottom of the stair.
- (6.23) (Addition) Grating cut from a standard length is to be provided with end banding.

8 Modifications to ANSI A14.3

The following paragraph numbers and drawing references refer to ANSI A14.3, which is a part of this standard. The text in each paragraph below is an addition, modification, exception, or deletion to ANSI A14.3 as noted. Paragraphs not mentioned below are accepted in their entirety.

Paragraphs not appearing in ANSI A14.3 are new paragraphs to be inserted in numerical order.

Ladder and cage fabrication details shall meet PIP STF05501 and 12-SAMSS-007.

(4.1.1) (Revision) Protection Requirements

Change the length of climb from 7.3 m to 6 m. The paragraph shall then be as follows:

"A cage, well, or ladder safety system shall not be required where the length of climb is 6 m or less above or below ground level, or above or below a floor or roof with access/egress from ground level, floor, or roof (see Figure 2, ANSI A14.3)."

Commentary Note:

A cage consists of the entire assembly around the ladder as shown in the figures of PIP STF05501.

(4.1.2) (Revision) Protection Requirements

Change the length of climb from 7.3 m to 6 m. The paragraph shall then be as follows:

"A cage or ladder safety system shall be provided where the length of climb is less than 6 m but the top of the ladder is at a distance greater than 6 m above ground level, floor, or roof (see Fig. 3, ANSI 14.3)."

(4.1.3) (Revision) Protection Requirements

Change the length of climb from 7.3 m to 6 m. The paragraph shall then be as follows:

"A cage, well, or ladder safety system shall be provided where a single length of climb is greater than 6 m but does not exceed 15.2 m (see Figure 4, ANSI A14.3)."

Commentary Note:

If a ladder provides access to a platform 4.0 meters above the ground, for example, the access ladder does not need to have a cage, but a safety guard (drop bar or safety gate) at the top of the ladder is required. All ladders with cages will have a safety guard.

(4.1.7) (Addition) Safety Guards

Add the following:

"Safety guards (commonly known as "drop bars" or "safety gates") shall be provided on fixed ladders serving elevations 1.2 m or more above the ground, existing platform or floor, unless the ladder terminates at a surface without a guard rail such as a building roof or a loading dock."

(4.1.8) (Addition) Materials of Construction

Add the following:

"Fixed stairs, and their appurtenances, guard rails, handrails, stair rails, and toe boards, shall be constructed of steel per 12-SAMSS-007 and SAES-M-001, or 32-SAMSS-005 or 32-SAMSS-006, as applicable.

Exception:

Wood or other suitable material may be used for unusually corrosive environments such as cooling towers, if approved by the manager of the proponent operating department with the concurrence of the Saudi Aramco Chief Fire Prevention Engineer, Dhahran.

(4.1.9) (Addition) Ladder Type

Add the following:

"Fixed ladders shall be of the side-step design, except tanks under 3 m high may use step-through ladders."

(4.1.10) (Addition) Cages and Wells Versus Safety Devices

Add the following:

"Ladder safety devices, rather than cages or wells, may be used on equipment such as communication towers, cranes, small-diameter tanks with floating roofs, and stacks, and in congested areas such as berth manifold loading arm tower structures. Other ladders shall use cages as specified herein."

(4.1.11) (Addition) Ladders Versus Grab Bars

Add the following:

"Grab bars (as shown in Figure 10, ANSI A14.3) shall not be used."

(5.4.3.4) (New Section) Use of Side Rails and Rungs

Side rails and rungs shall not be used for hangers or supports for any equipment, such as pipe and conduit.

Figures in ANSI A14.3

Figure 2 Change the length of climb from 24 ft to 6 m.

Figures 3 & 4 Change the 24 ft dimension to 6 m.

9 Modifications to PIP STF05501

The following paragraph addition refers to PIP STF05501, which is a part of this standard. The text below is an addition, modification, exception, or deletion to PIP STF05501 as noted. Paragraphs not mentioned below are accepted in their entirety.

"Fixed ladders shall be of the side-step design, except on tanks under 3 m high may use step-through ladders."

Revision Summary

15 March 2006 Revised the "Next Planned Update". Reaffirmed the contents of the document and reissued without any other changes.