

# Engineering Standard

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SAES-M-100

30 April 2005

## Saudi Aramco Building Code

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## Saudi Aramco DeskTop Standards

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## A Scope

The 2003 International Building Code of the International Code Council (ICC) in its entirety, with all amendments, errata, and supplements thereto, shall constitute the Saudi Aramco Building Code (SABC) except as modified by this Standard. The provisions of the SABC, hereinafter referred to as "this Code," shall apply to the design, construction, alteration, moving, demolition, repair and use of Saudi Aramco buildings.

For buildings with special functions, additional requirements can be found in the standards listed in the Special Appendix II of this code.

## B Conflicts and Deviations

B.1 Any conflicts between this standard and any other applicable Saudi Aramco Engineering Standards (SAES), Materials System Specifications (SAMSS), Standard Drawings (SASD) or industry standards, codes and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco.

B.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, Consulting Services Department of Saudi Aramco.

## C References

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

### C.1 Saudi Aramco References

#### Saudi Aramco Engineering Procedures

[SAEP-302](#)

*Instructions for Obtaining a Waiver of a  
Mandatory Saudi Aramco Engineering  
Requirement*

[SAEP-1150](#)

*Inspection Coverage on Projects*

#### Saudi Aramco Engineering Standards

[SAES-A-104](#)

*Wastewater Treatment, Reuse and Disposal*

[SAES-A-109](#)

*Site Planning for Prayer Shelters*

[SAES-A-112](#)

*Meteorological and Seismic Design Data*

<a href="#"><u>SAES-A-113</u></a>	<i>Geotechnical Engineering Requirements</i>
<a href="#"><u>SAES-A-114</u></a>	<i>Excavation and Backfill</i>
<a href="#"><u>SAES-A-204</u></a>	<i>Preparation of Structural Calculations</i>
<a href="#"><u>SAES-B-009</u></a>	<i>Fire Protection and Safety Requirements for Offshore Production Facilities</i>
<a href="#"><u>SAES-B-014</u></a>	<i>Safety Requirements for Plant and Operations Support Buildings</i>
<a href="#"><u>SAES-B-017</u></a>	<i>Fire Water System Design</i>
<a href="#"><u>SAES-B-019</u></a>	<i>Portable, Mobile and Special Fixed Firefighting Equipment</i>
<a href="#"><u>SAES-B-055</u></a>	<i>Plant Layout</i>
<a href="#"><u>SAES-H-001</u></a>	<i>Selection Requirements for Industrial Coatings</i>
<a href="#"><u>SAES-H-100</u></a>	<i>Painting Requirements for Industrial Facilities</i>
<a href="#"><u>SAES-H-101</u></a>	<i>Approved Protective Coating Systems</i>
<a href="#"><u>SAES-J-502</u></a>	<i>Analyzer Shelters</i>
<a href="#"><u>SAES-J-801</u></a>	<i>Control Buildings</i>
<a href="#"><u>SAES-K-001</u></a>	<i>Heating, Ventilation and Air Conditioning (HVAC)</i>
<a href="#"><u>SAES-K-100</u></a>	<i>Saudi Aramco Mechanical (HVAC) Code</i>
<a href="#"><u>SAES-M-001</u></a>	<i>Structural Design Criteria for Non-Building Structures</i>
<a href="#"><u>SAES-M-009</u></a>	<i>Design Criteria for Blast Resistant Buildings</i>
<a href="#"><u>SAES-N-004</u></a>	<i>Design and Installation of Building Thermal Insulation</i>
<a href="#"><u>SAES-O-109</u></a>	<i>Buildings Housing Sensitive or Vital Equipment</i>
<a href="#"><u>SAES-O-110</u></a>	<i>Protection of Vital Equipment</i>
<a href="#"><u>SAES-O-117</u></a>	<i>Gate House and Vehicle Lock</i>
<a href="#"><u>SAES-O-126</u></a>	<i>Blast-Resistant Control Buildings</i>
<a href="#"><u>SAES-O-128</u></a>	<i>Offshore Requirements</i>
<a href="#"><u>SAES-P-100</u></a>	<i>Basic Power System Design Criteria</i>
<a href="#"><u>SAES-P-103</u></a>	<i>Direct Current and UPS Systems</i>
<a href="#"><u>SAES-P-119</u></a>	<i>Onshore Substations</i>

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<a href="#"><u>SAES-P-123</u></a>	<i>Lighting</i>
<a href="#"><u>SAES-Q-001</u></a>	<i>Criteria for Design and Construction of Concrete Structures</i>
<a href="#"><u>SAES-Q-005</u></a>	<i>Concrete Foundations</i>
<a href="#"><u>SAES-Q-007</u></a>	<i>Foundations and Supporting Structures for Heavy Machinery</i>
<a href="#"><u>SAES-Q-009</u></a>	<i>Concrete Retaining Walls</i>
<a href="#"><u>SAES-S-050</u></a>	<i>Sprinkler and Standpipe Systems Components in Buildings</i>
<a href="#"><u>SAES-S-060</u></a>	<i>Saudi Aramco Plumbing Code</i>
<a href="#"><u>SAES-W-011</u></a>	<i>Welding Requirements for On-plot Piping</i>

#### Saudi Aramco Materials System Specifications

<a href="#"><u>09-SAMSS-016</u></a>	<i>Concrete Masonry Units and Concrete Building Bricks</i>
<a href="#"><u>09-SAMSS-088</u></a>	<i>Aggregates for Concrete</i>
<a href="#"><u>09-SAMSS-097</u></a>	<i>Ready-Mixed Portland Cement Concrete</i>
<a href="#"><u>09-SAMSS-106</u></a>	<i>Epoxy Coating of Steel Reinforcing Bars</i>
<a href="#"><u>12-SAMSS-007</u></a>	<i>Steel Structures</i>
<a href="#"><u>12-SAMSS-014</u></a>	<i>Pre-engineered Metal Buildings</i>

#### Saudi Aramco Standard Drawing

<i>AA-036322 Rev. 07</i>	<i>Anchor Bolt Details – Inch and Metric Sizes</i>
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#### Saudi Aramco Inspection Requirement

<i>Form 175</i>	<i>Inspection Requirements</i>
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#### Saudi Aramco General Instructions

<i>GI-0007.030</i>	<i>Inspection and Testing Requirements for Elevating/Lifting Equipment</i>
<i>GI-0400.001</i>	<i>Quality Management Roles &amp; Responsibilities</i>

#### C.2 Saudi Arabian Standards Organization

<i>SASO SSA-2</i>	<i>Steel Bars for the Reinforcement of Concrete</i>
<i>SASO SSA-184</i>	<i>Methods of Test for Bricks &amp; Blocks Made of Burnt Clay</i>

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<i>SASO SSA-185</i>	<i>Bricks Made from Burnt Clay</i>
<i>SASO SSA-186</i>	<i>Hollow Bricks from Burnt Clay for Walls</i>
<i>SASO SSA-224</i>	<i>Steel Fabric for the Reinforcement of Concrete</i>

### C.3 Industry Codes and Standards

#### American Concrete Institute

<i>ACI 304</i>	<i>Placing Concrete by Pumping Methods</i>
<i>ACI 318</i>	<i>Building Code Requirements for Structural Concrete</i>
<i>ACI 318M</i>	<i>Building Code Requirements for Reinforced Concrete</i>
<i>ACI 349</i>	<i>Code Requirements for Nuclear Safety Related Concrete Structures and Commentary</i>
<i>ACI 350/350R</i>	<i>Code Requirement for Environmental Engineering Concrete Structures</i>
<i>ACI 350.1/350.1 R</i>	<i>Tightness Testing of Environmental Engineering Concrete Structures</i>
<i>350.2R</i>	<i>Concrete Structure for Contaminant of Hazardous Materials</i>
<i>350.3/350R</i>	<i>Seismic Design of Liquid-Containing concrete Structures</i>
<i>350.4R</i>	<i>Design Considerations for environmental Engineering Structures</i>
<i>ACI 530</i>	<i>Building Code Requirements for Masonry Structures</i>
<i>ACI 530.1</i>	<i>Specification for Masonry Construction</i>

#### American Institute of Steel Construction

<i>AISC ASD</i>	<i>Manual of Steel Construction, Allowable Stress Design, American Institute of Steel Construction, Chicago, Il</i>
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#### American National Standards Institute

<i>ASME/ANSI A17.1</i>	<i>Safety Code for Elevators and Escalators</i>
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American Society for Testing and Materials

<i>ASTM A307</i>	<i>Standard Specification for Carbon Steel Bolts and Studs</i>
<i>ASTM A325/325M</i>	<i>Standard Specification for High-Strength Bolts, Steel, Heat Treated</i>
<i>ASTM A767</i>	<i>Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement</i>
<i>ASTM E84</i>	<i>Standard Test Method for Surface Burning Characteristics of Building Materials</i>
<i>ASTM E119</i>	<i>Standard Test Method for Fire Test of Building Construction and Materials</i>

American Welding Society

<i>AWS D1.1</i>	<i>Structural Welding Code - Steel</i>
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Crane Manufacturers Associations of America

<i>CMAA 70</i>	<i>Specification for Electric Overhead Traveling Cranes</i>
<i>CMAA 74</i>	<i>Specification for Top Running &amp; Under Running Single Girder Electric Overhead Traveling Cranes</i>

International Code Council (ICC)

<i>IBC 2003</i>	<i>The International Building Code</i>
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National Fire Protection Association (NFPA), where NFPA conflicts with SAES-M-100, the latter supersedes

Underwriters Laboratories

<i>UL 10B - 1988</i>	<i>Fire Tests of Door Assemblies</i>
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**D Modifications to International Building Code (IBC 2003)**

The following part, chapter and section numbers refer to the 2003 International Building Code (First Printing), which is part of this SAES. The text of each paragraph below is an addition, modification, exception or deletion as noted.

CHAPTER 1 - ADMINISTRATION

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Any requirement necessary to provide for the additional egress and fire safety of buildings not specifically covered by this code, shall be directed to the Manager, Loss Prevention Department.

Sec. 103 Department of building safety

(Deletion) Delete this section in its entirety.

Sec. 104.1 General

(Modification) Delete this section in its entirety and substitute the following:

The administration of this Code including interpretations, clarifications and waiving requirements of its provisions is vested in the Manager, Consulting Services Department or the Manager of the Loss Prevention Department. A table is contained in Special Appendix I indicating which Saudi Aramco department is responsible for each section of this Code. This table can be used as a guide for questions on specific sections of this standard or to determine which department is responsible for waivers.

Sec. 104.2 Applications and permits

(Modification) Delete "and issue permits" and "for which such permits have been issued" from this section.

Sec. 104.4 (Addition) Add the following: "The Manager, Inspection Department or his duly authorized representative has the responsibility to enforce the implementation of this code during construction and report any non-compliance conditions."

Sec. 104.6 Right of entry

(Deletion) Delete in its entirety.

Sec. 104.8 Liability

(Deletion) Delete in its entirety.

Sec. 104.10 Modifications

(Modification) Delete in its entirety and substitute the following:

Procedures for waiving requirements of this code shall be in accordance with the provisions of [SAEP-302](#).

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Sec. 105	Permits	(Deletion) Delete in its entirety.
Sec. 108	Fees	(Deletion) Delete this section and all subsections to 108 in their entirety.
Sec. 109	Inspections	
Sec. 109.1	General	(Modification) Delete entire paragraph and substitute the following paragraphs:  All inspections necessary for the application of this code is the responsibility of the Manager, Inspection Department or his representative.  General inspections shall be made as required to ascertain compliance with this Code, and shall include, but not be limited to, specific inspections listed in this Code.
Sec. 109.3	Required inspections	(Modification) Revise this paragraph to read: "The Inspection Department or its duly representative shall make the following inspections and shall either accept that portion of the construction as completed or shall notify the responsible project agency of failure to comply with this Code."  (Addition) Contractors responsible for design, procurement and construction of buildings are required to implement the Inspection document "Schedule Q" which identifies the specific Saudi Aramco quality system elements.
Sec. 109.3.1	Footing and foundation inspection	(Exception) In the last sentence, replace "ASTM C94" with " <a href="#">09-SAMSS-097</a> ".
Sec. 109.5	Inspection requests	(Modification) Delete in its entirety and substitute the following: "The responsible project agency shall advise in writing the Inspection Department or their duly designated representatives of

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any required inspection. Request for Inspection (RFI) should be prepared and submitted to the Inspection Department within the time constraint specified in [SAEP-1150](#)."

Sec. 110.1

Use and occupancy

(Modification) Change the first sentence to read: "No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the Loss Prevention Department has reviewed and approved the occupancy."

(Modification) Change the second sentence to read: "This shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction."

Sec. 110.2

Certificate issued

(Deletion) Delete in its entirety.

Sec. 110.3

Temporary occupancy

(Deletion) Delete in its entirety.

Sec. 110.4

Revocation

(Deletion) Delete in its entirety.

Sec. 111.1

Connection of service utilities

(Modification) Delete "for which a permit is required" and replace the word "released" by "approved".

Sec. 112

Board of appeals

(Deletion) Delete in its entirety.

Sec. 113

Violations

(Deletion) Delete in its entirety.

Sec. 114

Stop work orders

(Deletion) Delete in its entirety.

Sec. 115.2	Record	(Modification) Delete this section in its entirety and substitute "When an unsafe condition is revealed by an inspection, the inspector shall immediately file with the Project Agency a full and true report of such inspection and such unsafe condition."
Sec. 115.3	Notice	(Deletion) Delete this section in its entirety.
Sec. 115.4	Method of service	(Deletion) Delete this section in its entirety.
Sec. 115.5	Restoration	(Modification) Modify the first sentence to read as follows:  "The structure or equipment determined to be unsafe is permitted to be restored to a safe condition approved by the Loss Prevention and Consulting Services Departments".

## CHAPTER 2 - DEFINITIONS

Sec. 202	(Deletion) Delete definition of "Approved Fabricator".
	(Addition) Add the term "Battery Room" as defined in <a href="#">SAES-P-103</a> .
	(Modification) Wherever the term "Building Official" is used in this Code, it shall mean the following:  Consulting Services Department and Loss Prevention Department for the administration, interpretation and waiving requirements of this code.  Inspection Department and Project Agency for the enforcement of this code as outlined by GI-0400.001.
	(Modification) Delete the definition of "Owner" and substitute with: "Saudi Aramco".
	(Modification) Throughout the document replace the words "Night Clubs" with "Coffee Shops", "churches" with "mosques" and "dance halls" with "social events hall".

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## CHAPTER 3- USE AND OCCUPANCY CLASSIFICATION

- Sec. 303.1 (Modification) Delete the word "Taverns and bars" on the breakdown of Group A-2 occupancy.
- Delete also "(not including food or drink consumption)" mentioned after "Dance halls" on the breakdown of Group A-3 occupancy.
- Delete also the word "Funeral parlors" from the breakdown of Group A-3 occupancy.

## CHAPTER 9 - FIRE-PROTECTION SYSTEMS

- Sec. 901.2 (Addition) When approved by the Loss Prevention Department, details of new fire protection installations and details of changes, additions, modifications of any existing "Approved" fire protection installations shall be reviewed and approved by the Fire Protection Department.
- Sec. 903.1 General
- (Additions) The following additional requirements for sprinkler systems shall apply:
- Pipe or tubing, fittings and valves shall be in accordance with [SAES-S-050](#) (Sprinkler and Standpipe Systems in Buildings).
- Welding methods and procedures shall be in accordance with [SAES-W-011](#) (Welding Requirements for On-Plot Piping).
- Sec. 903.4.2 Alarms
- (Modifications) In the first sentence add the words "and visual" after the word "audible".
- Sec. 903.5 Testing & maintenance
- (Additions) Add the following statement "The testing of the sprinkler system shall be witnessed by representatives from Loss Prevention and Fire Protection Departments. The installer or maintenance people shall notify the concerned departments 48 hours in advance of any testing."
- Sec. 905.2 Installation of standpipe systems
- (Addition) the following additions apply:
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(Exception) Pipe, tube, fittings and valves used in standpipe and combined systems shall conform to the requirements of [SAES-S-050](#).

(Addition) Add the following: "Hose stations shall be in accordance with [SAES-B-017](#) and [SAES-B-019](#).

Hose connection shall be within easy reach of a person standing on the floor and in no case shall be over 1.5 m (5 ft) from the floor."

Valves of approved indicating type shall be provided at the main riser for controlling branch lines for Class II services supplying more than one hose station."

Sec. 909.19 System Acceptance

(Modifications) In the first sentence change "issued a certificate of occupancy" to read "occupied".

In exception line 2 change "issue a temporary certificate of occupancy" to read "give permission to occupy,".

## CHAPTER 10 - MEANS OF EGRESS

Sec. 1006.3 Illumination emergency power

(Addition) Add the following item to the second paragraph.

Lighting requirements in accordance with [SAES-P-123](#).

## CHAPTER 11 - ACCESSIBILITY

Sec. 1109.2.1 Unisex toilet and bathing rooms

(Deletion) Delete this section.

Sec. 1110.1 Signs

(Deletion) Delete item 7.

Sec. 1110.2 Directional signage

(Deletion) Delete "and bathing room indicating the location of the nearest unisex toilet or bathing room" from item 4 of this section.

## CHAPTER 12- INTERIOR ENVIRONMENT

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Sec. 1203.1

General

(Modification) Change the section to read "Buildings and structures enclosing spaces intended for human occupancy shall be provided with ventilation in accordance with Section 1203.4, the *Saudi Aramco Mechanical (HVAC) Code* ([SAES-K-100](#)) and [SAES-K-001](#). In the case of conflicts, the stricter requirement applies."

CHAPTER 13- ENERGY EFFICIENCY

Sec. 1301.1.1

Criteria

(Modification) Add the following "The minimum insulation requirements for Saudi Aramco buildings are stated in [SAES-N-004](#)."

CHAPTER 15 - ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

Sec. 1501.1

Scope

(Addition) Add the following to this section "The preferred roof systems for new flat roofs with a slope of less than 13 mm (½ inch) vertical to 305 mm (12 inches) horizontal are: a) Inverted, loose laid and ballasted single-ply membrane system; b) Fully adhered single ply membrane systems; c) Loose laid ballasted single ply membrane systems. Acceptable systems are 1.52 mm (0.060") thick EPDM (Ethylene Propylene Diene Monomer) or 5 mm (0.2") Modified Bitumen membrane systems. Other flat roof systems can only be used with written approval by the Supervisor, Civil Engineering Unit, Mechanical & Civil Engineering Division, Consulting Services Department.

Ballasted roofs shall have a separation layer installed below the gravel ballast.

Ballasted roofs shall have a minimum of 19 mm (¾") washed gravel placed to a minimum thickness of 50 mm (2").

All completed flat roofs shall be subjected to a flood test for a period of no less than 24 hours. Roof flood tests shall be carried out in a manner acceptable to the Company Representative and the Saudi Aramco Inspection Department Representative."

- Sec. 1503.4.2      Overflow drains and scuppers (Add section)
- At a minimum, a combination of roof drains and scuppers, or roof drains and overflow drains of the same size, together shall accommodate an instantaneous rainfall intensity of 250 mm/hr (10 in/hr).
- Sec. 1506.1      Scope
- (Addition) Add the following at the end of the section: "Asbestos-cement or any other asbestos products shall not be used for new construction."
- Sec. 1507.4.2      Deck slope
- (Modification) Delete the entire paragraph and substitute:
- "Roofs with metal coverings shall have a minimum roof slope of 1 unit vertical in 12 units horizontal.
- A Standing-Seam roof system shall have a minimum roof slope of 1 unit vertical in 25 units horizontal."
- Sec. 1509.2      Penthouses
- (Addition) Add the following sentence: "Access shall be provided to all mechanical equipment located on the rooftop as required by the International Mechanical Code".

## CHAPTER 16 - STRUCTURAL DESIGN

- Sec. 1601.1      Scope
- (Addition) All structural calculations shall be prepared in accordance with [SAES-A-204](#).
- Sec. 1604.3.1      Deflection
- (Addition) Add the following paragraphs 1604.3.1.1 through 1604.3.1.7:
- Sec. 1604.3.1.1      To minimize vibration due to pedestrian traffic, the depth of steel floor beams supporting large open areas shall be less than 1/20 of the span length. Also, the size and spacing of open web bar joist shall be designed to limit the vibration to the "Slightly Perceptible" range on the Modified Reiher-Meister Scale.
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- Sec. 1604.3.1.2 The horizontal and vertical deflection of girts shall not exceed 1/180 of the span under the total load.
- Sec. 1604.3.1.3 Girts shall be spaced so that deflection of wall panels under design loads does not exceed 1/120 of the span.
- Sec. 1604.3.1.4 Roof panel deflections shall not exceed 1/180 of the span under total load.
- Sec. 1604.3.1.5 The vertical deflection of purlins or rafters under total load, for buildings with metal decks shall not exceed 1/180 of the span. Additionally, the deflection of purlins or rafters under total dead load plus an additional load of 0.24 kpa (5 psf) shall not exceed the limit required to provide positive drainage of the roof.
- Sec. 1604.3.1.6 The vertical deflection of crane runway beams and monorails shall be computed based on the maximum wheel loads (excluding impact) and shall not exceed the following deflections:

Monorails and under-running crane beams	Span/450
Top running cranes (runway beams)	Span/600 *
Jib cranes	Length/225
Monorail cantilevers	Length/225

\* For crane service classifications of D, E and F refer to CMAA 70 and CMAA 74 Specifications.

- Sec. 1604.3.1.7 The horizontal deflection of crane beams shall not exceed 1/400 of the span.

Table 1604.5 Occupancy category.

(Addition) Add the following to Occupancy Category IV: "All buildings within the plant fence and all high-rise buildings."

Table 1607.1 Uniform and concentrated loads

Add the following values:

Category	Uniform Load kpa	(psf)
Other Use or Occupancy:		
File Rooms	7.2	(150)*
Copy Rooms	4.8	(100)*
Laboratories	4.8	(100)*

Mechanical Rooms 7.2 (150)\*

\* Use actual equipment weight or stored material weights when greater.

- Sec. 1609.3 Basic wind speed  
  
(Modifications) Delete in its entirety and substitute: "The minimum basic wind speed for determining design wind pressure shall be in accordance with [SAES-A-112](#)."
- Sec. 1609.4 Exposure  
  
(Addition) Add the following: "Exposure Factors shall be as defined in [SAES-A-112](#)."
- Sec. 1609.8 (Additional Section) Deflection due to wind
- Sec. 1609.8.1 Building lateral drifts shall be checked for design wind speeds specified in [SAES-A-112](#) and shall be limited to the values shown below.
- | Building Type  | Max. Lateral Drift   |
|--|--|
| Buildings with metal panels, wall cladding and bare frames   | Height/100   |
| Buildings with partition walls and/or sensitive architectural elements attached to or in contact with the building frame | Height/375   |
| Buildings with cranes (for load combinations including crane loads)  | Height/240 or 50 mm (2 in) at the crane rail (whichever is less) |
- Sec. 1609.8.2 Additionally, the lateral drift (displacement) of the building frame shall not in any way hamper the operation of equipment, doors, mechanical devices, storage racks, cranes or other items susceptible to lateral drift.
- Sec. 1610.1 General  
  
(Addition) Add the following: "Concrete retaining walls shall be in accordance with the requirements of [SAES-Q-009](#)."
- Sec. 1612.2 Definitions  
  
Base Flood Elevation  
  
(Modification) Delete the definition in its entirety and substitute
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the following: "The elevation of the base flood, including wave height as defined in the project proposal, if applicable."

#### Design Flood

(Modification) Delete the area number 2 and substitute the following: "2. Area designated as a flood hazard area as defined in the project proposal, if applicable".

#### Design Flood Elevation

(Modification) Delete the definition in its entirety and substitute the following: "The elevation of the "design flood", including wave height shall be as defined in the project proposal, if applicable".

#### Flood Hazard Area

(Deletion) Delete the definition of "Flood Hazard Map".

#### Sec. 1612.3

##### Establishment of flood hazard areas

(Modification) Delete this section in its entirety and substitute the following: "Flood prone areas and the base flood elevation shall be defined in the project proposal, if applicable"

#### Sec. 1615.1

In the second paragraph of this section, delete "Figures 1615(1) through (10)" and substitute "[SAES-A-112](#)"

### CHAPTER 17 - STRUCTURAL TESTS AND SPECIAL INSPECTIONS

#### Sec. 1704.1

##### General

(Modification) Revise to read: "The inspections listed in section 1704 shall be performed in addition to inspections required by Section 109, when directed by the Manager, Inspection Dept."

#### Sec. 1704.4

##### Concrete construction

(Deletion) Delete exceptions 1 through 5.

### CHAPTER 18 - SOILS AND FOUNDATIONS

#### Sec. 1801.2

##### Design

(Addition) add "[SAES-A-114](#)" at the end of the section.

Sec. 1802	Foundation and Soils Investigations  (Modification) Delete in its entirety and substitute "Foundation and Soil Investigations: A site specific geotechnical investigation is required for all structures, including existing foundations which undergo a change in loading conditions, and foundations, per the requirements of <a href="#">SAES-A-113</a> ."
Sec. 1803.5	Compacted fill material  (Modification) Delete in its entirety and substitute "Refer to <a href="#">SAES-A-114</a> for compacted fill requirements."
Sec. 1804	Allowable Load-Bearing Values of Soils  (Deletion) Delete in its entirety and substitute "The allowable load bearing values shall be determined by the geotechnical investigation when required by <a href="#">SAES-A-113</a> . If geotechnical investigation is not required, the net applied bearing pressure on the footing shall not exceed 100 kpa (2000 psf)".
Sec. 1805.1	General  (Modification) Add "and <a href="#">SAES-Q-005</a> " to the end of the first sentence. Delete "Section 1803.5" and substitute " <a href="#">SAES-A-114</a> ."
Sec. 1805.2	Depth of footings  (Deletion) Delete "below the undisturbed ground surface shall be 12 inches (305 mm)" and substitute "below the existing or finished grade surface shall be 600 mm".
Sec. 1805.4	Footings  (Modification) Add "and <a href="#">SAES-Q-005</a> " to the end of the first sentence.
Sec. 1805.4.1.2	Vibratory loads  (Modification) Add "For heavy machinery, refer to <a href="#">SAES-Q-007</a> " to the end of the first sentence.
Sec. 1805.4.2	Concrete footings  (Modification) Add " <a href="#">SAES-Q-005</a> and <a href="#">SAES-Q-001</a> ."

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- Sec. 1805.4.2.1      Concrete strength  
  
(Modification) Change concrete compressive strength from 17237 kpa (2,500 psi) to 28,000 kpa (4,000 psi).
- Sec. 1805.4.3      Masonry-unit footings  
  
(Exception) Add "Use of masonry-unit footings shall be limited to one-story temporary light-frame structures."
- Sec. 1805.4.5      Timber footings  
  
(Deletion) Delete in its entirety.
- Sec. 1805.4.6      Wood foundations  
  
(Deletion) Delete in its entirety.
- Sec. 1805.5          Foundation walls  
  
(Addition) Add "Concrete Ring Wall Foundations: Concrete ring walls for tanks shall be designed and constructed in accordance with [SAES-Q-005](#)".
- Sec. 1805.8.3      Removal of expansive soil  
  
(Modification) Delete "Section 1803.5" and substitute "[SAES-A-114](#)."
- Sec. 1806            Retaining Walls  
  
(Modification) Add " in accordance with [SAES-Q-009](#)" after "designed" in the first sentence.
- Sec. 1809            Timber piles  
  
(Modification) Delete section 1809.1 through section 1809.1.3.
- Sec. 1810.1.1      Materials  
  
(Modification) Delete this section in its entirety and substitute "The design and specification for construction of all plain and cast-in-place concrete structures shall be in accordance with [SAES-Q-001](#) and [09-SAMSS-097](#)".
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## CHAPTER 19 - CONCRETE

(Modification) Delete Chapter 19 in its entirety (except as referenced below) and substitute: The design and specification for construction of all plain and cast-in-place concrete structures shall be in accordance with [SAES-Q-001](#) and [09-SAMSS-097](#), except as amended in additions 19.1 through 19.5 below:

- Sec. 19.1            General design requirements shall be in accordance with Chapter 16 "Structural Design" of this code, and [SAES-A-112](#), "Meteorological and Seismic Design Data".
- Sec. 19.2            Section 1911 - Minimum slab provision
- (Modification) Delete section 1911.1 in its entirety and substitute: "The minimum thickness of concrete floor slabs supported directly on the ground shall be 100 mm (4 inches).
- Sec. 19.3            Anchor bolts embedded in concrete shall be in accordance with Standard Drawing AA-036322, [SAES-Q-005](#) and ACI 318.
- Sec. 19.4            Section 1914 of the IBC and ACI 304 shall apply to pneumatically placed concrete.
- Sec. 19.5            Liquid containing structures other than prestressed concrete tanks shall be designed in accordance with ACI 350/350R, 350.1, 350.2R, 350.3, and 350.4R. This does not apply to temporary or emergency type containment structures.

## CHAPTER 21 – MASONRY

- Sec. 2101.1            Scope
- (Addition) Add the following: "In addition, masonry foundations shall comply with the applicable provisions of [SAES-Q-005](#) and masonry retaining walls shall comply with the applicable provisions of [SAES-Q-009](#)."
- Sec. 2101.2            Design methods
- (Exception) "Masonry shall comply with the provisions of the working stress design method or strength design method. Prestressed masonry and empirical design methods are not allowed."
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- Sec. 2103.1      Concrete masonry units
- (Addition) Add the following at the end of the paragraph:  
"Portland Cement for concrete masonry units shall be in accordance with [09-SAMSS-016](#)."
- (Addition) "Concrete building brick, hollow load-bearing concrete masonry units, hollow non-load-bearing concrete masonry units, and solid load-bearing concrete masonry units shall also be in accordance with [09-SAMSS-016](#)."
- Sec. 2103.2      Clay or shale masonry units
- (Modification) Delete the term "ASTM C 62" wherever it appears in this section and substitute SASO SSA-184 and SASO SSA-185."
- (Modification) Delete the term ASTM C 126 wherever it appears in this section and substitute SASO SSA-184 and SASO SSA-185.
- (Modification) Delete the term ASTM C 652 wherever it appears in this section and substitute SASO SSA-184 and SASO SSA-186.
- Sec. 2103.7      Mortar
- (Modification) Modify the first sentence to read: "The mortar shall be type S or M Mortar Cement as per the proportion specifications of Table 2103.7(1) or the property specifications of Table 2103.7 (2). The specified compressive strength of mortar shall not be less than 12.4 MPa (1800 psi). Mortar shall not be retempered.
- Sec. 2103.10      Grout
- (Modification) Add the following sentence to the end of the paragraph, "Grout shall not be retempered."
- Sec. 2103.11.1      Deformed reinforcement bars
- (Exception) Delete in its entirety and substitute: "Reinforcement steel bars shall conform to SASO SSA-2/1992, hot-rolled, high tensile, deformed steel. The reinforcement steel bars shall be fusion bonded epoxy coated as per the requirements of [09-SAMSS-106](#)". These bars shall be acceptable under ACI 318M specified limitation of 422 MPa (60 ksi). For design variances, see section 4.18 of [SAES-Q-001](#).
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- Sec. 2103.11.4      Wire fabric
- (Addition) Add to the end of the paragraph: Welded wire fabric shall conform to SASO SSA-224, (cold drawn) wire with a minimum yield strength of 240 MPa (34.8 ksi). Galvanized welded wire fabric shall conform to ASTM A767 and shall be acceptable reinforcing in lieu of epoxy coated welded wire fabric coated in accordance with [09-SAMSS-106](#).
- Sec. 2103.12      Aggregate (Add section)
- (Addition) "Aggregates shall be in accordance with [09-SAMSS-088](#)."
- Sec. 2103.13      Water
- (Addition) "For the purposes of this chapter, water shall not contain more than 500 ppm total dissolved solids."
- Sec. 2104.1.2.6      Grouted masonry
- (Addition) Add a new section as follows: "Grouted masonry shall be constructed in such a manner that all elements of the masonry act together as a structural element."
- Sec. 2104.1.9      Masonry lifts (Add section)
- Units may be laid to the full height of the grout pour and grout shall be placed in a continuous pour in grout lifts not exceeding 1220 mm (4 ft). When it can be demonstrated the grout spaces can be properly filled and the written approval of the Supervisor, Civil Engineering Unit, Mechanical & Civil Engineering Division, Consulting Services Department is obtained, then grout lifts may be greater than 1220 mm (4 ft). Lifts over 1220 mm (4 ft) will require Special Inspection during the pour.
- Sec. 2104.1.10      Bond beams (Add section)
- Where bond beams are required by design, all cells of the last course of masonry below the bond beam shall be filled with grout. The grout pour shall be stopped a minimum of 20 mm below the top of the masonry. Grout shall be retained by use of metal lath strips laid over cells in the joint below this course and interrupted at cells containing vertical reinforcement. Bond beam reinforcing steel shall be connected to vertical reinforcement. Masonry walls shall cure at least three days before pouring grout for high-lift
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- grouted construction. Reinforcement shall be placed prior to grouting."
- Sec. 2104.1.11      Masonry abutment to slab (Add section)
- When a concrete slab (i.e., floor slab, exterior slab, etc.) abuts a masonry wall, a reinforced bond beam shall be provided in the masonry course directly adjacent to the slab(s)."
- Sec. 2104.1.12      Pipes and conduits embedded in masonry
- (Addition) "Sleeves, pipes, conduits, etc., of aluminum shall not be embedded in masonry unless effectively protected to prevent aluminum-concrete reaction. Protection shall be by wrapping with a suitable plastic tape applied so as to provide adequate protection at the overlap or by painting using an [SAES-H-001](#), APCS-26."
- Sec. 2104.4.2.1      Temperature
- (Modification) Item 3 - Delete this item in its entirety and substitute: "Mortar and grout shall not be retempered."
- Sec. 2105.2.2.1.2      (Exception) Add the following sentence "The minimum compressive strength of concrete masonry units shall be 13.1 MPa (1900 psi). The corresponding specified compressive strength of masonry  $f'_m$  shall be limited to a maximum of 10.34 MPa (1500 psi) as per table 2105.2.2.1.2."
- Sec. 2107.2.7      Minimum reinforcement
- (Addition) Add the following paragraph: "The minimum vertical reinforcement shall be 12 mm diameter bars at 1.2 meters spacing (#4 bars at 4 ft spacing). The minimum horizontal joint reinforcement shall be 2 longitudinal truss bars of 5 mm diameter placed at 400 mm (16-inch) centers."

## CHAPTER 22 - STEEL

- Sec. 2201.1      Scope
- (Modifications) Modify this section to read: "the provisions of this chapter and [12-SAMSS-007](#) govern the quality, design, fabrication and erection of steel used structurally in building or structures."

Sec. 2204.2

Bolting

(Addition) Add the following at the end of this section: "When standard washers are not sufficient for oversize holes in base plates, plate washers shall be furnished."

Sec. 2204.2.2

Bolt specifications

(Addition) Add the following paragraphs:

ASTM A325 or A325M, Type 1 high-strength bolts shall be used in all primary bolted connections. The minimum size of ASTM A325 bolts shall be M20 (¾") diameter. Larger ASTM A325 bolts may be used when required to meet connection capacity requirements and shall be clearly flagged on the erection drawings.

All bolts, nuts, and washers shall be properly identified and marked. Bolts and nuts shall be marked with the material grade and manufacturer's logo. Washers shall be marked with the manufacturer's logo. All fasteners not so marked shall be rejected. Should any unmarked fasteners be installed, they shall be removed. Mechanical testing of unmarked fasteners shall not constitute justification for their use.

Ladder, stair tread, purlin, girt, doorframe and handrail connections may be made with standard machine bolts, conforming to ASTM A307.

ASTM A307 bolts, other than anchor bolts, shall be limited in size to M16 (5/8) inch diameter and smaller.

Sec. 2205.1.1

Amendments to AISC ASD, ninth edition, Specification (Add this section)

I4. Shear connectors

(Modification) Change the reference in paragraph 3 from "C33 aggregates" and revise to read as follows "aggregates complying with [09-SAMSS-088](#)".

J2. Welds

(Additions) Add the following:

"Inspection shall conform to Saudi Aramco Inspection Requirements Form 175 attached to the Purchase Order."

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

"A minimum of 10% of randomly selected girth welds (circumferential welds) of pipes used as piling shall be 100% radiographed."

"Girth welds of flange to pipe sections for all primary load-bearing members shall be 100% Ultrasonically and Magnetic Particle tested."

"It is acceptable to use fillet-welded lugs with magnetic particle inspection for skid-mounted equipment with a total lift weight of less than 3000 kg."

### M3. Shop painting

(Addition) Paint and coatings and required surface preparation shall be in accordance with [SAES-H-001](#), [SAES-H-100](#) and [SAES-H-101](#).

### Chapter N - Plastic Design

(Modification) The design approach in this chapter may only be used for the design of blast resistant buildings per [SAES-M-009](#).

## CHAPTER 23 - WOOD

### Sec. 2303.1 General

(Addition) Add the following paragraph: "Species, size and grade of wood members shall be restricted to those listed in the Saudi Aramco Materials System Catalog excluding those items designated as "ordinary" lumber."

### Sec. 2304.11 Protection against decay and termites

#### Sec. 2304.11.1 General

(Addition) Delete this item in its entirety and substitute: "The Saudi Aramco operating area is an active termite zone. Buildings and wood structures shall include termite pretreatment to protect against termite attack."

## CHAPTER 25 - GYPSUM BOARD AND PLASTER

### Sec. 2511.1 General

(Addition) Add the following: "Plaster shall not be retempered."

### Sec. 2511.2 Supports

(Addition) Add the following: "Gypsum boards manufactured to metric dimensions may be used provided the necessary adjustment is made to the stud spacing required in Table 25-G (e.g., 16" is changed to 400 mm and 24" is changed to 600 mm).

### Sec. 2512.1 General

(Addition) Add the following: "Plaster shall not be retempered."

## CHAPTER 27 – ELECTRICAL

Delete in its entirety and substitute the following:

"The electrical components, equipment and systems used in buildings shall be designed and constructed in accordance with the provisions of [SAES-P-100](#)."

## CHAPTER 28 – MECHANICAL SYSTEMS

Delete in its entirety and substitute the following:

"The heating, ventilating and air-conditioning (HVAC) systems used in buildings shall be designed and constructed in accordance with the provisions of [SAES-K-100](#)."

## CHAPTER 29 - PLUMBING SYSTEMS

Delete in its entirety and substitute the following:

"The plumbing systems used in buildings shall be designed and constructed in accordance with the provisions of [SAES-S-060](#)."

## CHAPTER 30 – ELEVATORS AND CONVEYING SYSTEMS

### Sec. 3001.2 Referenced Standards

(Modification): Add the following "Inspection and test shall be as required in GI-7.030, Inspection and Testing of Elevating/Lifting Equipment"

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## CHAPTER 33 - SAFEGUARDS DURING CONSTRUCTION

### Sec. 3301.3 Scope

(Modification) Replace the section with the following:

"The provisions of this chapter and Saudi Aramco Construction Safety Manual shall govern safety during construction and protection of adjacent public and private properties. In the case of conflicts, the stricter requirement applies"

### Sec. 3304.1.2 Surcharge

(Modification) Delete the second sentence and substitute the following: "Any planned excavation which could potentially undermine an existing foundation shall be braced, shored or the foundation shall be underpinned or otherwise protected against settlement or lateral movement. Any excavation which intersects an imaginary plane which extends 45 degrees to the horizontal, projected downward from the bottom toe of the adjacent footing, is considered to have the potential to undermine the foundation.

### Sec. 3307 Protection of adjoining property

(Deletion) Delete this section in its entirety.

## CHAPTER 34 - EXISTING STRUCTURES

### Sec. 3409.7.9 Toilet rooms

Delete this section in its entirety.

### Sec. 3409.7.10 Dressing, fitting and locker room.

Delete the last sentence in this section.

## APPENDIX H – SIGNS

### H101.1 General

(Addition) Add the following: "Each building shall have identification signs posted on the sides of the main entrances of the building and other sides as deemed necessary by the building owner. All signs required by this Code shall be designed in accordance with the signing guidelines of Saudi Aramco Corporate Identity, Public Relations Department. Signs should not pose any hazards to occupants in buildings subject to blast loads.

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## APPENDIX J – GRADING

### J101.1 Scope

(Addition) Add the following sentence: Excavation and backfill shall be in accordance with [SAES-A-114](#) and the requirements of this appendix as modified below.

### Sec. J103 Permits required

(Deletion) Delete this section, including all subsection in their entirety.

### Sec. J104 Permits applications and submittals

(Deletion) Delete this section, including all subsection in their entirety.

30 April 2005

#### **Revision Summary**

Major revision to adopt IBC 2003.

## Special Appendix I – Table of Chapter & Waiver Responsibilities

<b>2003 IBC Chapter</b>	<b>Reviewing Organization</b>
1 Administration	CSD
2 Definitions	CSD
3 Use and Occupancy Classification	LPD
4 Special Detailed Requirements Based on Use and Occupancy	LPD
5 General Building Heights and Areas	LPD
6 Types of Construction	LPD
7 Fire-resistant-Rated Construction	LPD
8 Interior Finishes	LPD
9 Fire-protection Systems	LPD
10 Means of Egress	LPD
11 Accessibility	LPD
12 Interior Environment	CSD
13 Energy Efficiency	CSD
14 Exterior Wall	CSD
15 Roof Assemblies and Rooftop Structures	CSD
16 Structural Design	CSD
17 Structural Tests and Special Inspections	CSD
18 Soils and Foundations	CSD
19 Concrete	CSD
20 Aluminum	CSD
21 Masonry	CSD
22 Steel	CSD
23 Wood	CSD
24 Glass and Glazing	CSD
25 Gypsum Board and Plaster	CSD
26 Plastic	CSD
27 Electrical	CSD
28 Mechanical Systems	CSD
29 Plumbing Systems	CSD
30 Elevators and Conveying Systems	CSD
31 Special Construction	CSD
32 Encroachments into the Public Right-Of-Way	CSD
33 Safeguards during Construction	CSD
34 Existing Structures	LPD

## Special Appendix I – Table of Chapter & Waiver Responsibilities (Cont'd)

### APPENDIX

C	Group U-Agricultural Building	LPD
E	Supplementary Accessibility Requirements	LPD
F	Rodent Proofing	CSD
H	Signs	LPD
I	Patio Covers	LPD
J	Grading	CSD

**Note: 1.** *Material standards will be reviewed by the department responsible for the associated chapter.*

### Legend:

- CSD - Consulting Services Dept.
- LPD - Loss Prevention Dept.



## Special Appendix II – Table of Building Types, Applicable Standards and Design Requirements

Building Description	Applicable Mandatory Standards	Remarks
Blast Resistant Buildings	<a href="#">SAES-M-009</a>	
Control Buildings	<a href="#">SAES-J-801</a> <a href="#">SAES-B-009</a> <a href="#">SAES-O-126</a>	Offshore Blast Resistant
Analyzer Shelter	<a href="#">SAES-J-502</a>	
Prayer Shelters & Mosque	<a href="#">SAES-A-109</a>	
On-Shore Substations	<a href="#">SAES-P-119</a> , <a href="#">SAES-O-100</a> <a href="#">SAES-O-109</a>	
Buildings Housing Sensitive & Vital Equipment such as Electrical	<a href="#">SAES-O-109</a> <a href="#">SAES-O-110</a>	Refer to <a href="#">SAES-O-100</a> Para. 1.1.3
Switchgear, Diesel Generators, Computers, Remote Micro-processors, etc.	<a href="#">SAES-O-109</a>	
Communication Buildings	<a href="#">SAES-O-109</a>	Critical Communication
Gatehouses	<a href="#">SAES-O-117</a> Std. Dwgs. AA-036759 & AE-036818	
Process Interface Buildings (PIBs)	<a href="#">SAES-J-801</a> , <a href="#">SAES-O-109</a>	
Waste Water Facilities	<a href="#">SAES-A-104</a> , Para. 4.7.2.3.2	
Compressor Sheds	<a href="#">SAES-M-001</a>	
Sunshades	<a href="#">SAES-M-001</a> or <a href="#">12-SAMSS-014</a>	<a href="#">12-SAMSS-014</a> for cold-formed steel
Hammams	Std. Drawing AA-036011	
Pre-Engineered Metal Buildings	<a href="#">12-SAMSS-014</a>	
Marine Terminals	<a href="#">SAES-B-060</a>	<a href="#">SAES-B-068</a> , Sec. 6.4.8.
Unmanned Satellite Instrument Centers	<a href="#">SAES-O-109</a> ( <a href="#">SAES-O-126</a> , Para. 3.1.8).	
Offshore Buildings	<a href="#">SAES-O-128</a> , <a href="#">SAES-B-009</a>	
Battery Rooms	<a href="#">SAES-J-801</a> & <a href="#">SAES-P-103</a>	<a href="#">SAES-B-069</a> (Eyewash)

**Note:** All buildings shall comply with the requirements of [SAES-O-100](#), [SAES-B-009](#) (offshore), [SAES-B-014](#) and [SAES-B-055](#) as applicable. The listed specific requirements are only for guidance and are not all inclusive. All maintenance and operational requirements shall be met.