Engineering Standard

SAES-T-744 29 April 2020

Design Criteria and Installation of Communication Towers

Document Responsibility: Onshore Structures Standards Committee

Contents

Summary of Changes

Paragraph Number		Change Type (Addition, Modification, Deletion)	Technical Change(s)
Previous Revision (27 April 2017)	Current Revision (27 April 2020)		
1	1	Modification	Revised SAES-T-744 to overlay with the updated international standard for communication towers, ANSI/TIA-222-H.
N/A	2.2.2	Addition	The minimum risk category for structures considered under this standard shall be risk category IV.
5.5	N/A	Deletion	Removed the following statement from the previous version of the standard “Ice loading shall not be considered in the tower loading calculations.”
N/A	9.6	Addition	Added requirement to hot dip galvanize full length of anchor rods to align with 12-SAMSS-007 requirements.

1. Scope

The structural standard for antenna supporting structures, antennas and small wind turbine support structures, ANSI/TIA-222-H in its entirety, with all amendments, errate and supplements thereto, shall constitute the basis of Saudi Aramco Engineering standard SAES-T-744, Design Criteria and Installation of Communication Towers except as modified by this standard.

This standard covers mandatory requirements governing the design and installation of self-supporting, guyed steel and monopole communication towers. This includes antenna towers used for HF, VHF/UHF, microwave, wireless, FM/TV broadcasting, CATV, and base station antenna installation system.

This standard is not applicable to communication towers constructed with aluminum.

2. Conflicts and Deviations

Any conflict between this document and other applicable Mandatory Saudi Aramco Engineering Requirements (MSAERs) shall be addressed in writing to the EK&RD Coordinator.

Any deviation from the requirements herein shall follow internal company procedure SAEP-302.

3. 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 references listed below, in addition to the references already listed in ANSI/TIA-222-H unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedures

SAEP-302	Waiver of a Mandatory Saudi Aramco Engineering Requirement

Saudi Aramco Engineering Standards

SAES-A-112	Meteorological and Seismic Design Data
SAES-A-113	Onshore Geotechnical Engineering Requirements
SAES-B-063	Aviation Obstruction Marking and Lighting
SAES-H-001	Coating Selection and Application Requirements for Industrial Plants and Equipment
SAES-H-101V	Approved Saudi Aramco Data Sheets – Paints and Coatings
SAES-O-208	Wired and Wireless Communications for Security Application
SAES-P-111	Grounding

SAES-P-123	Lighting
SAES-Q-001	Criteria for Design and Construction of Concrete Structures
SAES-Q-005	Concrete Foundations

Saudi Aramco Materials System Specifications

09-SAMSS-097	Ready-Mixed Concrete
12-SAMSS-007	Fabrication of Structural and Miscellaneous Steel

Saudi Aramco Standard Drawings

AA-036391	Equipment Grounding System for Telecommunications Facilities
AA-036322	Anchor Bolt Details Inch and Metric Sizes

3.2 Industry Codes and Standards

American Institute of Steel Construction (AISC)

AISC	Manual of Steel Construction 360-10

American Society of Civil Engineers (ASCE)

ASCE 7-10	Minimum Design Loads for Buildings and Other Structures

American Society for Testing and Materials (ASTM)

ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

Telecommunications Industry Association (TIA)

ANSI/TIA -222-H	Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures

Research Council on Structural Connections (RCSC)

RCSC	Specifications for Structural Joints Using High-Strength Bolts

4. Terminology

4.1 Acronyms

None

4.2 Definitions

None

5. Modifications to ANSI/TIA-222-H

The following part, chapter and section numbers refer to Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures

(ANSI/TIA-222-H) which is part of this SAES. The text of each below paragraph is an addition, modification, exception or deletion as noted.

OBJECTIVE (Modification) Replace ASCE 7-16 with ASCE 7-10.

1.6 (Addition) Establishing the height of communication towers shall require the review, approval and concurrance of the General Authority of Civil Aviation (GACA).

1.7 (Addition) Communication towers erected on the roof tops of buildings or offshore platforms shall require the acceptance and concurrence of the Building Owner or Proponent. The maximum tower base reactions shall be furnished to the Proponent or Building Owner for verification of the structural adequacy of the existing structure to support these additional loadings. The tower cannot be installed until the structural verification has been completed.

1.8 (Addition) Guyed towers shall not be installed on offshore structures.

1.9 (Addition) All guyed tower masts for communication sites require separate security fencing for each guy if the full tower site is not enclosed in the facility secured perimeter. Refer to SAES-O-208 for security fence requirements.

1.10 (Addition) Any coating in addition to hot dip galvanizing shall comply with the requirements of SAES-H-001 and SAES-H-101V.

2.2.2 (Addition) Delete the first paragraph and replace with "The minimum risk categorization for structures covered under this Standard shall be Risk Category IV in Table 2-1."

2.2.2.2 (Addition) Loading capacity of the tower shall be calculated for the known loading to be on the tower at its commissioning plus any additional loading expected to occur within one year after commissioning.

2.2.2.3 (Addition) For new communication towers, aside from the loading provisions mentioned in section item 5.8 above, provide future tower loadings equivalent to 300% of the identified loadings or six (6) 1,200 mm (4 ft.) diameter sets of microwave antennas with two (2) 32 mm (1-¼ in) diameter coaxial transmission cables per antenna, which ever will result in greater stresses to the communications tower structure. Antennas' locations of future loads shall be established as per the instruction of Saudi Aramco representative(s).

2.2.2.4 (Addition) Antenna mounting bracket support(s) assembly shall be considered as an additional load of the communications tower aside from the self-weight of antenna/(s). These collateral loads shall be considered in the tower loading for both dead load and wind load. For wind load calculations of the mounting bracket support, derivation of the Effective Projected Area (EPA) shall follow the procedure specified in TIA-222H.

2.6.4 (Modification) Delete the first paragraph and replace with "The Design Basic wind speed for the location of the tower shall be determined from SAES-A-112". If such data is not available for a particular location, contact the Environmental Engineering Division. The minimum operational wind speed for tower structures in Saudi Arabia shall be 100 kilometers per hour.

2.7.4 (Modification) Seismic load consideration in the design of communication towers shall be dependent on the tower zone location as defined and elaborated in SAES-A-112.

4.9.1 (Addition) Bolted connections shall conform to RCSC, Specification for Structural Joints Using High Strength Bolts.

5.4.1 (Modification) Replace "Table 5.1" with "Section 4.1 of 12-SAMSS-007"

5.4.1 (Addition) Lattice framing for communication towers shall not contain hollow tubular steel members.

5.4.2 (Deletion) Delete in its entirety.

5.5 (Modification) Replace "AISC 360 M2" with 12-SAMSS-007. Delete reference to AISC 201-06.

5.6.1 (Modification) Delete sentence and replace with "All structural steel members shall be hot dipped galvanized in accordance with ASTM A123 with minimum thickness of 120 microns. For offshore communication towers, minimum thickness shall be 140 microns."

6.0 (Deletion) Delete in its entirety.

9.3 (Modification) Delete in its entirety and replace with "Geotechnical investigation requirements shall conform to SAES-A-113."

9.4 (Addition) Foundations and concrete shall comply with 09-SAMSS-097, SAES-Q-001, and SAES-Q-005.

9.6 (Modification) Delete in its entirety and replace with "Anchor rods shall be hot-dip galvanized for the full anchor rod length in accordance with 12-SAMSS-007.

10.1 (Addition) All tower legs and anchors shall be bonded to form a grounding electrode system, which shall be bonded to the nearest available grounding system per SAES-P-111 and Standard Drawing AA-036391.

10.1 (Addition) Lightning protection were necessary to protect equipment and lighting systems shall conform to the requirements of SAES-P-111.

11.0 (Modification) Replace "Federal Communications Commission" and "Federal Aviation Authority" with "SAES-B-063".

11.1 (Addition) Lighting on communication towers shall comply with SAES-P-123.

13.4 (Addition) Each tower leg and anchor shall be identified with labels. The labels shall be located in a clearly visible location such as the bottom of the tower and top of anchor.

13.4 (Addition) All newly erected communication towers shall be provided with a unique tower identification by providing nameplate tag that includes the Saudi Aramco asset number. Other information to be included in the name tag are manufacturer's name, date of manufacture, type of tower, tower height and site location name. This name tag information will be installed in one of the leg's tower approximately 1 meter above the tower's base plate.

18.1 (Addition) All electrical power cables of tower lightings shall be installed using rigid steel conduit (RSC) and/or heat resistance armored cable wire.

18.2 (Addition) Installation of antenna transmission cables or waveguides shall comply with the recommended manufacturer's standard requirements and procedures. This comprises, but not limited to complete assembly of hanger clips, support brackets and/or pillows.

18.3 (Addition) Transmission cables or waveguides shall be provided with hoisting grip located at least 1.50 meters (5.00 feet) from the antenna connector. Allow a sufficient length of cable or waveguide leader between the connector and the grip to reach the antenna input when hoisting is completed.

Do not use one (1) hoisting grip for hoisting two (2) or more cables or waveguides. Use hoisting grips at intervals of no more than 60 meters (200 feet).

18.4 (Addition) Transmission cables or waveguides shall be provided with label lead tag material.

18.5 (Addition) Transmission cable lines shall be grounded along the vertical run near the top, near the bus bar or above the entry of waveguide and at the entrance of the line (port entry) into the equipment shelter.

The midpoint of the vertical run of transmission shall be grounded if the height of the line exceeds 60 meters (200 feet).

Document History

29 April 2020	Major revision of scope to overlay with the recently updated international standard for communication towers, ANSI/TIA-222-H.
23 April 2017	Major revision considered tower loadings requirements from Global System for Mobile Radio (GSM) Service Providers, security surveillance cameras and monitoring equipment, and to meet present and future communications radio and wireless technological advancements, such as Tetra, Vessel Traffic Management System antennas, etc.
2 May 2012	Editorial revision to change the primary contact.
10 September 2011	Revised the “Next Planned Update.” Reaffirmed the content of the document, and reissued with no other changes.