

Engineering Standard

SAES-K-003

31 May, 2004

Air Conditioning Systems for Communications Buildings

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1 Scope

- 1.1 This Standard describes the supplemental Heating, Ventilation and Air Conditioning (HVAC) requirements for Communication Buildings and communication equipment rooms within buildings, in addition to the general HVAC requirements of [SAES-K-001](#) and [SAES-K-100](#). Communication Rooms within the Operations Center buildings of Bulk Plants and Air Fueling Facilities are covered by this standard only in case of mutual agreement between Distribution Technical Support Department and Computer and Communication Engineering Department Engineering Division.
- 1.2 Excluded from this standard are communication rooms, data closets and termination box rooms in buildings that are not essential in the production, processing and transportation of hydrocarbons, as defined in [SAES-O-100](#).

2 Conflicts and Deviations

- 2.1 Any conflicts between this Standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Industry Standards, Codes, Forms and Saudi Aramco Mandatory Drawings (SAMDs) shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department, Dhahran.
- 2.2 All requests to deviate from this standard shall be directed to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department, Dhahran.

3 References

All referenced specifications, standards, codes, forms, drawings and similar material shall be of the latest issue (including all revisions, addenda and supplements) unless stated otherwise.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-302](#)

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

Saudi Aramco Engineering Standards

[SAES-A-112](#)

Meteorological and Seismic Design Data

[SAES-K-001](#)

Heating Ventilating and Air Conditioning (HVAC)

[SAES-K-002](#)

Air Conditioning Systems for Essential Operating Facilities

[SAES-K-100](#)

Saudi Aramco Mechanical (HVAC) Code

[SAES-O-100](#)

General Requirements Safety and Security

3.2 Industry Codes and Standards

American Society of Heating, Refrigerating & Air-Conditioning Engineers

ASHRAE 52

Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

4 Saudi Arabian Environmental Conditions

The environmental conditions at locations of the Saudi Aramco operating areas are listed in [SAES-A-112](#); Meteorological and Seismic Design Data.

5 Requirements for Communication Facilities with Power Supply

5.1 Indoor Air Temperature and Humidity Control

The HVAC systems of Communication Buildings shall be designed for 22°C (71.6°F) indoor air dry bulb temperature and shall be able to maintain this temperature within $\pm 2^\circ\text{C}$ ($\pm 3.6^\circ\text{F}$). The HVAC systems shall also provide humidity control to keep the indoor air relative humidity level at 50% with a $\pm 10\%$ tolerance.

Exception:

Humidity control is not required in those Communication Buildings which are served by window or mini-split air conditioning units. If the manufacturer of any digital equipment requires more stringent temperature, humidity or air filtration levels than listed herein, the Project Management Team shall specify these requirements for the HVAC system design before the completion of HVAC load calculations.

5.2 Cooling Load Calculations

For HVAC systems which do not have any fresh air make-up the cooling load calculations shall be prepared with 0.5 air change per hour infiltration rate.

5.3 Air Filtration Requirements

HVAC systems of Communication Facilities shall have fresh air make-up filters (where fresh air make-up is used) and internal air recirculation filters. The fresh

air make-up filters shall have a minimum of 25% dust spot efficiency and the internal air recirculation filters shall have a pre-filter with a minimum of 25% dust spot efficiency and a final filter with a minimum of 60% dust spot efficiency, as measured by ASHRAE 52 test method. Viscous oil filters shall not be used for Communication Facilities.

5.4 Battery Room Requirements

HVAC systems of Battery Rooms for Communication Facilities shall be designed in accordance with the requirements of [SAES-K-002](#). Humidity control is not required in Battery Rooms.

5.5 HVAC System Considerations

5.5.1 For Communication Facilities direct expansion (DX) type HVAC systems shall be used. Chilled water system may be used only with the prior approval of Communications Engineering Division.

5.5.2 For Communication Facilities computer room type air conditioning units shall be used. Other type of air conditioning units may be used only with the prior approval of C&CED/Engineering Division.

5.6 Standby Capacity of HVAC Systems

All HVAC systems covered by this Standard shall be provided with standby capacity as follows. If the system is served by two or more normally operating air handling units, the capacity of the standby unit(s) shall be at least 50% of the system's maximum design capacity. If the system is served by one normally operating air handling unit only, the capacity of the standby unit shall be equal to the capacity of the normally operating unit.

5.7 Fresh Air Intake

Location of fresh air intake shall be at a minimum of 2.4 meters above grade. All air intakes shall have sand-trap-louver, bird screen and manual volume damper.

5.8 Indoor Air Temperature and Humidity Recording

Indoor air temperature and humidity levels shall be recorded on a chart recorder in each Communication Facility. The recorder shall have the capability of continuously recording for a minimum duration of 28 days. The temperature measurements shall be performed 1.5 m above the floor and 0.4 m in front of the equipment.

5.9 Control System Requirements

HVAC control systems shall be capable of providing the following functions:

- Automatic change over between the operating and standby units weekly, and/or in the event of operating unit failure.
- Remote alarm in case of any HVAC equipment failure.

5.10 Other Requirements

Insulation of refrigerant pipes exposed to outdoors shall be provided with galvanized steel or aluminum sheet metal cladding, fastened with corrosion resistant metal straps or screws.

6 Requirements for Passively Cooled Communications Shelters

6.1 Maximum Inside Air Temperature

The inside air temperature of Passively Cooled Communications Shelters shall not exceed 37°C.

6.2 Indoor Air Temperature Recording

The indoor air temperature of Passively Cooled Communications Shelters shall be recorded in accordance with the requirements of paragraph 5.8. Humidity level of the Shelter and Battery Room temperature shall not be recorded.

6.3 Battery Room Requirements

6.3.1 The Battery Room of the Passively Cooled Communication Shelters shall be provided with a separate passive cooling system to maintain a 37°C maximum indoor air temperature.

6.3.2 The Battery Room shall not have any ventilation opening that would compromise the effectiveness of the passive cooling system.

6.4 Testing Requirements

6.4.1 Factory-built Passively Cooled Shelters with their cooling systems shall be subjected to a Thermal Performance Test at the factory under simulated indoor thermal load and ambient air temperature conditions to ensure that the indoor air temperature limit stated above will not be exceeded.

6.4.2 Cooling systems of Shelters built on site shall also be subjected to a factory Thermal Performance Test, and it shall be guaranteed by the

manufacturer of the cooling system that the indoor air temperature of the site-built Shelter will not exceed the temperature limit stated above.

- 6.4.3 The indoor thermal load shall represent the actual heat dissipation of the equipment housed by the Shelter and shall be stated in the Performance Specification of the Shelter.
- 6.4.4 During the Thermal Performance Test the ambient air conditions shall be simulated by maintaining a 24-hour temperature cycle in the test chamber as follows.
- a) The Summer Night Dry Bulb Temperature (SNDBT) shall be held constant for four consecutive hours.
 - b) The temperature shall be increased gradually from the SNDBT to the Summer Design Dry Bulb Temperature (SDDBT) at 2.5% exceedance during the next six hours.
 - c) The SDDBT at 2.5% exceedance shall be maintained during the next two hours.
 - d) The temperature shall be gradually increased from the SDDBT at 2.5% exceedance to the SDDBT at 1% exceedance during the next one and a half hours.
 - e) The SDDBT at 1% exceedance shall be maintained during the next one hour.
 - f) The temperature shall be decreased gradually from the SDDBT at 1% exceedance to the SDDBT at 2.5% exceedance during the next one and a half hours.
 - g) The SDDBT at 2.5% exceedance shall be maintained during the next two hours.
 - h) The temperature shall be decreased gradually to the SNDBT during the next six hours.

The SDDBTs shall be obtained from [SAES-A-112](#); Meteorological and Seismic Design Data, and the SNDBT shall be established by Environmental Protection Dept./Environmental Engineering Division for each site. PMT shall obtain concurrence from C&CED/Engineering Division for the SNDBT prior to the finalization of Performance Specification for the Passive Cooling System.

- 6.4.5 The Thermal Performance Test shall include a test chamber temperature cycle stabilization period of 3-5 days and a Shelter temperature recording period shall follow. After this stabilization period, the indoor temperature of the Shelter shall be recorded for a minimum of 48
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consecutive hours. If the temperature cycles of the test chamber become unstable during the 48 hours recording period, the 48 hour temperature recording shall be repeated.

- 6.4.6 The Thermal Performance Test shall be witnessed by representatives of C&CED/Engineering Division and the HVAC/Utilities Group of Consulting Services Department.

Revision Summary

31 May, 2004

Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with no other changes.