

Engineering Standard

SAES-T-435

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Telecommunications: Station Protection

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Saudi Aramco DeskTop Standards

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1 Scope

This Standard prescribes mandatory requirements for station protection (less than 25 pair cables) of telecommunications plant.

2 Conflicts and Deviations

Any deviations, providing less than the mandatory requirements of this standard require written waiver approval as per Saudi Aramco Engineering 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 latest edition of the references listed below unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

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

SAES-P-111	<i>Grounding</i>
SAES-T-018	<i>Telecommunications - Symbols, Abbreviations and Definitions</i>
SAES-T-629	<i>Telecommunications Buried Cable and Wire</i>
SAES-T-634	<i>Telecommunications Cable Testing & Acceptance</i>
SAES-T-887	<i>Telecommunications - Electrical Coordination & Protection at Power Plants and Radio Stations</i>
SAES-T-903	<i>Telecommunications - Outside Plant Electrical Protection and Grounding</i>
SAES-T-916	<i>Communications Building Cable</i>
SAES-T-928	<i>Telecommunications OSP Buried Plant</i>
SAES-T-938	<i>Telecommunications Outside Plant System Design</i>

3.2 Industry Codes and Standards

National Electrical Code

NEC

National Electrical Code

Underwriter Laboratories, Inc.

UL 497

Protectors for Paired Conductor Communication Circuits

UL 497A

Secondary Protectors for Communication Circuits

UL 497B

Protectors for Data Communication and Fire Alarm Circuits

4 Definitions and Terms

Distribution Facility: is the exchange plant from the central office to the user end (including the distribution point).

Entrance Facility: is the exchange plant from the outside plant distribution point at the street to the station protector.

Fuse: is an electrical safety device consisting of, or including, a wire or strip of fusible metal that melts and opens the circuit when the current becomes excessive.

MGN (Multi-Grounded Neutral): is a neutral conductor of a wye-connected electrical supply system having at least four grounds in each mile of wire, with the primary and secondary neutrals solidly interconnected, and power ground connections at individual services.

5 Design

5.1 General

5.1.1 The 60 Hz Flashover Voltage Requirements

- a) A minimum of 5,000 VDC breakdown voltage between the line cord conductors and parts of the set in constant contact with the user (telephone hand set).
- b) A minimum of 1,000 VDC to parts in short term contact with the user.

5.1.2 Fuseless Station Protectors

5.1.2.1 UL Listings

Fuseless station protectors shall be Underwriter's Laboratories (UL) listed as a complete assembly. See UL 497, UL 497A, or UL 497B for detailed requirements.

5.1.2.2 Fail Safe

Arresters used on Saudi Aramco telecommunication circuits must be a type that always fail in the shorted/grounded condition.

5.1.3 Fuseless station protectors shall be used when:

- a) A 24 AWG building entrance cable is used and its metal shield is grounded to the station ground and bonded to the distribution cable shield.
- b) A distribution cable serves the entrance facility from:
 - A cable terminal with a 24 AWG stub connecting it to the distribution facility.
 - Pedestal terminal equipped with terminal blocks, provided the cable pair is connected to the terminal block binding post by a minimum of 450 mm of 24 AWG leads.
- c) A distribution facility is entirely underground or buried; entrance facility may be aerial, underground, or buried.

5.1.4 Selecting protectors

Solid state type protectors shall be the basic method of protection at all stations.

5.2 Station Protectors Application

5.2.1 Electrical protection for telecommunication stations is mandatory in any of the following conditions:

- a) Station equipment is operated by local AC or DC power in excess of 50 volts, or the station is in a bathroom, near a swimming pool, on a boat dock or in a boat (the station equipment location and length of the cords must be such that the handset cannot be submerged in water or taken into a shower).
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- b) Loop exposed to lightning (all loops in Saudi Aramco operating area are considered exposed to lightning), except any on-premises extensions which are not exposed to 300 volts or more and not extended to a separate building more than 23 m away.

5.2.2 Heat Coils

Station protectors shall not be equipped with heat coils due to the limited protection they provide and certain components of equipment may be damaged by currents which are too small to operate the heat coils.

5.2.3 Fusible Link

5.2.3.1 Fusible links must be provided in all entrance facilities.

5.2.3.2 The fusible link may be one of the following:

- a) The conductors of the main distribution cable.
- b) The terminal cable stub.
- c) The entrance cable.

5.2.3.3 To keep the protector from overheating and to reduce the fire hazard, the fusible link must:

- a) Be between the exposed plant and protectors.
- b) Begin (or be) at the outside plant distribution cable end of the service entrance when aerial drops or buried service wires are used.

5.2.3.4 Conductor Size

The fusible link conductors must be 24 AWG or smaller.

5.2.3.5 Removing Sheath

Do not remove sheath from a 24 or 26 AWG entrance cable to make connections to a terminal unless the terminal is mounted in an enclosed metallic terminal box.

5.2.4 Methods of Furnishing the Fusible Link

5.2.4.1 Service Entrance Facilities

All new service entrance cables shall be shielded cable which has its shield and armor, if present, effectively grounded at both ends. Refer to [SAES-T-903](#) for more details.

5.2.4.2 Buried Wire/Drop Wire as Service Entrance

- a) Bond the shield or armor of the wire to the grounded strand, shield or armor of the distribution plant.
- b) Connect the shield or armor to the station ground.
- c) Connect the wire's conductors to the distribution plant.
- d) A minimum of 600 mm of stub fuse cable or a minimum of 150 mm of terminal leads must be visible.

5.2.4.3 Fuse-Link Wire

Never install fuse-link wire at the house end of the service drop.

Commentary Note:

This is to avoid any fire hazard at the building from fusing of the fuse-link wire.

5.2.4.4 Distribution Plant

- a) 24 or 26 AWG conductors in shielded cable may provide the fusible link in the distribution plant when the conductors are located where the drop or cable entrance connection is made.
- b) Do not expose service entrance facilities to power facility contacts above 300 volts to ground.
- c) Stubs containing 24 AWG conductors may provide the fusible link. Stubs from the main cable to a terminal must be at least 600 mm long.
- d) A minimum of 600 mm of stub fuse cable or a minimum of 150 mm of terminal leads must be visible.

5.2.4.5 Fixed Count Terminals

- a) Distribution plant may provide fusible link if the terminal is mounted on 24 or 26 AWG distribution cable.
- b) If the distribution cable is 22 AWG or larger, 24 or 26 AWG conductors shall provide the fuse link inside the 600 mm terminal stub.

5.3 Station Protectors Description

Only fuseless type station protectors shall be used on Saudi Aramco

telecommunication circuits.

5.4 Station Protectors Installation

5.4.1 Selecting Protector Locations

The selection for station protector's location depends on:

5.4.1.1 Maximum Length of Ground Wire

Ground wire runs from the station protector to the ground source (building ground etc.) must not exceed 6 m.

5.4.1.2 Protector Location

- a) Protector and entrance facilities shall be located at least 300 mm from:
 - Electric light or power line facilities
 - Facilities of other utilities
- b) Avoid flammable materials and areas where the atmosphere may be combustible.
- c) Locate 150 mm or more away from window curtains.
- d) Avoid excessively damp locations.
- e) Avoid locations where the protector will be subjected to tampering and where the material might be piled against it.

5.4.1.3 Protectors at Waterside Locations

For telephones installed in boats, plug-in dockside service, or telephones on docks, the protector shall be installed at the nearest land or any nearer location where a proper ground is available.

5.4.1.4 Minimum Ground Wire Capacity

Ground wire runs from the station protector to the ground source (building ground etc.) shall be an insulated No. 6 AWG solid copper conductor or coarser.

5.4.1.5 Solid State Protectors

Solid state station protectors shall be used for all new stations.

5.4.2 Installation

Where protection for multiple services is required, a protected building terminal shall be installed in a terminal box for station protection.

5.5 Station Protection - Mobile Home Installation

Work done at mobile home locations shall be of a permanent nature.

5.5.1 Testing Mobile Home Chassis for Foreign Voltages

Before making bodily contact with any metal portion of the mobile home, confirm that there are no hazardous voltages on the mobile home chassis (trailer body to ground) using a volt-ohm-meter (VOM).

5.5.2 Installing Station Protectors, Wire, and Cable

5.5.2.1 Locating the Protector

The protector shall be located on a post as near as possible (not more than 300 mm) to the mobile home. Direct protector attachment to the trailer is not permissible.

- a) Grounding.
- b) Power ground shall be the preferred ground electrode.
- c) If the power service to the trailer is not readily accessible refer to paragraph 5.7.2.

5.5.2.3 Bonding Mobile Homes

The mobile home chassis must be bonded directly to the telephone ground electrode using No. 6 AWG ground wire to limit the differences in electrical potential that may develop between telephone equipment, metal surfaces, and the wiring of the mobile home.

5.5.2.4 Wiring

When the post cannot be placed 300 mm or less from the mobile home, a conduit from the post to the mobile shall be used to protect station wiring from damage. If metal conduit is used, place a bond between it and the ground at each end of the conduit to prevent forming chokes.

5.5.2.5 Connection

- a) Where a power ground rod is used, connect the protector ground and chassis ground to the grounding medium with separate UL listed clamps. Bonding of grounding connections to power ground facilities must be done in accordance with [SAES-P-111](#).
- b) Never coil or wrap ground wire around pipes or run it through metal rings.
- c) Do not make bends less than 150 mm in the ground wire (wire between protector and ground source).
- d) Attach No. 6 AWG ground wires to the post with station wire nails or galvanized clamps.
- e) Attach No. 6 AWG ground wire to the post with 10 mm staples or clamps.

5.5.2.6 Burying Ground Wire

Ground wire shall be buried to a minimum depth of:

- a) 450 mm under lawns
- b) 450 mm under driveways
- c) 600 mm where the earth may be disturbed in the future

5.6 Installation - Special Services Circuit Safeguarding on User Premises

5.6.1 Examples of special services lines, which require guarding against service interruption due to accidental contact are the following:

- a) Carrier telegraph.
- b) Program supply (radio).
- c) Remote control, signal and alarm, including fire, industrial security and various instrument gauge lines.
- d) Ringing supply lines for hospital, fire and industrial security departments.
- e) Special facilities intended for use in case of major disaster.
- f) Trunk circuits (digital & analog).

5.6.2 Extreme care must be exercised when working on or near special service circuits. Unauthorized work on these lines may result in a service interruption, or accidental start of special equipment.

5.7 Station Grounding Requirements – Description

5.7.1 Preferred Ground Electrodes

- a) The power service ground electrode or ground system shall be used as the telephone protector ground electrode except as permitted in paragraph 5.7.2.
- b) The telephone protector grounding conductor may be connected to:
 - Power service equipment enclosure (external portions of enclosure only)
 - Power service grounding electrode conductor
 - Other ground electrodes as permitted by NEC, Article 800

5.7.2 If the power service (first choice ground source) is not located within 6 m of the telephone station protector, relocate the telecommunication protector, or one of the following electrodes may be used if it is bonded to the power service ground and forms a part of the building ground system:

- a) Grounded metal frame of the building.
- b) Ground ring encircling the building at 0.76 m minimum depth, of No. 2 AWG minimum copper conductor, and having a minimum circumference of 6 m.
- c) All the above grounds present on the premises must be bonded together regardless of the distance between electrodes or ground systems.
- d) A 25 ohms or less ground electrode bonded to power service ground.
- e) Ground resistance measurements shall be made in accordance with [SAES-T-887](#).

5.8 Station Grounds Installation

5.8.1 The ground wire shall be located where:

- a) It will be continuous (without splices) and free from sharp bends
- b) It will not be subjected to tampering
- c) The run will be as short as possible, and no longer than 6 m.

5.8.2 Notes

- a) Do not fish ground wires through walls or under floors.
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- b) The ground wire may run through the same entrance as the station wire if:
 - A station protector is mounted outside, and
 - The ground is located under the building
- c) Do not run the station protector ground wire in attics.
- d) Bury the ground wire running from a building to an exterior ground connection.
- e) Avoid locating the ground wire where it is likely to be disturbed.
- f) Never encircle the ground wire with a metal ring because the ring will act as an RF choke.

5.8.3 Ground Conductor Connections

In grounding (bonding) wire runs, sharp kinks and bends shall be avoided. Slack ground wire shall not be coiled or wrapped around the ground electrode. Ground wires may be stapled or clamped in position, but they must not be run through bridle rings, closed metallic clips, sleeves, metallic pipes, or wrapped around nails or any other objects.

5.8.4 Inside Station Wire Connections

To create a choke to prevent lightning from following the wire, each of the inside station wire conductors shall be coiled with three or four turns about 25 mm diameter before being connected to the station protector.

5.8.5 Conduit for Ground Wires

When conduit is required for ground wires, always use non metallic conduit. If metallic conduit must be used, the ground wire shall be bonded to the conduit at each end. Also, when OSP cables run through metallic conduits, bond the cable metallic shield and armor if present to each end of the conduit.

Exception:

For an exception to this requirement, refer to [SAES-T-629](#).

6 Installation

The installation of station protectors shall be in accordance with this standard and other related standards (paragraph 3 above) and with the design documentation approved by Saudi Aramco at the time of design. All design drawing symbols shall be in accordance to [SAES-T-018](#). For station protection of 25 or more pair cables, refer to [SAES-T-916](#).

Refer to [SAES-T-887](#) for appropriate protection requirements if the cable is subjected to severe exposure due to fault current or ground potential rise (GPR). Refer to [SAES-T-928](#) for appropriate separation requirements from other subsurface facilities or structures (pipelines, power lines, water, gas, sewer, CATV, etc.). Refer to [SAES-T-938](#) for the Saudi Aramco central office conductor loop resistance limits.

7 Testing and Inspection

All station protectors shall be Underwriters Laboratories (UL) listed or equivalent. All station protection shall be tested with the cable in accordance with [SAES-T-634](#).

Revision Summary

12 October 2005

Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with editorial changes.