

Engineering Standard

SAES-T-914

28 January, 2004

Telecommunications Distribution Cable

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Saudi Aramco DeskTop Standards

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I Scope

This standard prescribes mandatory requirements governing the design, extension and placement of telecommunication outside plant distribution cable.

II 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](#).

III References

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

A. 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-T-018](#)

*Telecommunications Symbols, Abbreviations &
Definitions*

[SAES-T-634](#)

*Telecommunications - Cable Testing and
Acceptance*

[SAES-T-938](#)

*Telecommunications - Outside Plant Systems
Design*

B. Industry Codes and Standards

Building Industry Consulting Service International

BICSI Chapter 2

*Telecommunications Distribution Methods
Manual*

General Telephone and Electronics

GTE 832 Series

Exchange Area Transmission

GTE 914 Series

Distribution Cable

Rural Electrification Administration

REA PE-39

Specification for Filled Telephone Cables (Solid PIC)

IV Design

The GTE 914-000-070, Distribution Cabling - Conventional Distribution Design, Issue 5, Aug. 1991 and GTE 914-100-071 - Fixed Count Terminals Engineering Applications are hereby recognized as Saudi Aramco Engineering Standard SAES-T-914, "Telecommunications Distribution Cables". Mandatory items and modifications are:

4 Modifications to GTE 914 Series

The following paragraph numbers refer to GTE 914 Series on "Distribution Cables", which is part of this standard. The text in each paragraph below is an addition, exception, modification, or deletion to GTE 914 as noted. Paragraph numbers not appearing in GTE 914 are new paragraphs to be inserted in numerical order.

4.1 GTE Section 914-000-070: Distribution Cabling - Conventional Distribution Design, Issue 5, Aug. 1991

4.1.1 General

4.1.1.1 Paragraph 1.1 (Purpose) This section provides:

- General information about "distribution cabling".
- Specific information about "conventional design" of distribution cabling.

4.1.2 Overview

4.1.2.1 Paragraph 2.2 (Acronyms, Terms, and Definitions): The following explains the acronyms and terms used in this section. The terms and definitions, as presented, are specific to distribution cabling and facility area planning.

Addressable Locations: A service location that can be identified by a numbered address specified by Saudi Aramco to identify the physical location of a Saudi Aramco Housing Unit or Proponent Office Building.

Committed Pairs: Feeder cable pairs from the host or remote switching unit that are terminated on the feeder (IN) side of a connector. These cable pairs are multiple free and committed to a particular connector in 25 pair groups.

Dedicated Pairs: Cable pairs that are permanently assigned and have continuity from the central office main distribution frame or from a connector to a terminal.

Digital Connectivity Capability (DCC): Facilities that will support up to 144 kb/s transmission requirements. That is, services which require up to this level of capability can be provided "on demand" with only special terminating equipment as required for the specific service. This capability is primarily a function of loop length parameters and grooming requirements for the copper network.

Commentary Note:

Transmission up to 144 kb/s and beyond can also be provided directly via fiber, coax, etc., without these considerations.

Distribution Facilities: Portions of facilities, which are:

- Located within a service section.
- Designated to serve only customers within the service section where they are located.
- Equipped with terminals for connection to service drops.

Facility Area (FA): A well-defined geographic area whose size is based on the number of housing units and user locations one Facility Area Connector (FAC) will serve.

Commentary Note:

Once the area boundaries are established by Planning and Engineering, the boundaries must be documented on outside plant records.

Facility Area Plan (FAP): A FAP consists of the following:

- A clearly defined area, called Facility Area, with dedicated distribution cable plant.
- A single cross-connect for each facility area, called a Facility Area Connector (FAC).

Fixed Count Terminal: Any terminal on buried or aerial cable that has a cable count designated by engineering personnel. It is the only count accessible for connecting subscribers to the network.

Housing Unit: A single-family residence or each unit of a multi-family residence such as apartment buildings.

Proponent Location: A building that is used to house one or more Saudi Aramco proponents. These include Saudi Aramco proponent buildings such as office building, schools, hospitals, administration office buildings, oil and gas producing, and other industrial building complexes, etc.

RDAP: Rural (Remote) Distribution Area Plan.

Ready Access Terminal: A terminal with full accessibility to the cable's compliment for service.

Commentary Note:

Saudi Aramco does not use this type of terminal.

RTs: Remote Terminals - A digital system with switching or pair-gain capability. It supplements feeder plant by using T1 or fiber span line connection to:

- The host office.
- Another remote switching terminal.
- A corresponding central office terminal.

Service Section: A geographic area which:

- Is contiguous.
- Defines a distribution cable network/area administered as a unit.
- Is (normally) synonymous with a "facility area" where FAP and RDAP is implemented (refer to [SAES-T-938](#)).

Spare Pairs: Pairs in a cable, which are not terminated and are available to be assigned to any terminal in the distribution area where they appear. When spliced into a specific terminal, these pairs will be cut off at the serving terminal and become dedicated pairs.

Wiring Limits: A telecommunications station wiring administration method, which lists the specific residences or buildings (by house number or building number) that are to be served from a specific cable terminal.

4.1.3 Distribution Cable Design

- 4.1.3.1 Paragraph 3.1 (Recommended Design): The FAP design should be the first design considered for all new areas that qualify.

Commentary Note:

Transmission parameters of OSP Local Loops must comply with the GTE 832 (Copper Conductors) Series. Refer to [SAES-T-938](#), Outside Plant Systems Design.

The Conventional Distribution design ("Conventional Design" or CD) is the design for distribution cable to implement for all applications that do not

meet FAP or RDAP application parameters. Conventional Distribution design is explained below in Paragraph 4.1.5.

- 4.1.3.2 Paragraph 3.2 (Cable Systems): In designing an adequate cable system, each feeder cable and distribution cable must be designed as a component part of the total system and not as an individual unit.
- 4.1.3.3 Paragraph 3.3 (Distribution Cable Size): Size all facility area distribution cables on the basis of:
- Two (2) pairs per living unit (minimum).
 - An estimate of service demand (i.e., one cable pair per nine (9) square meters of usable office space, per the BICSI, Telecommunications Distribution Methods Manual, Chapter 2, page 9).

Commentary Note:

Segregating distribution and feeder, functionality into its own cable sheath is a worthwhile objective, to the extent that multiple sheaths exist or new sheath is necessary. It may not, however, be prudent to place a new sheath if existing capacity is sufficient.

- 4.1.3.4 Paragraph 3.4 (Distribution Cable Gauge/Loading): Gauge distribution cables by using the Resistance Engineering to Measured Limits (REML) transmission design procedures. Generally, no loading is required within the first 3,658 meters from the central office or remote terminal. If loading is required on any customer service within the facility area, the load coil spacing must be compatible with the loading arrangement used in the feeder cable complement that serves the loaded distribution complement.

Special service lines (e.g. Private Automatic Branch Exchange PABX trunks, data circuits, etc.), that require loading need individual attention. However, for administrative purposes, such circuits shall be contained within one or more 25-pair cable binder groups in the feeder cable. In the distribution cable, if loading is required, load the entire 25-pair complement.

- 4.1.3.5 Paragraph 3.5 (Sub-Surface Cable)
- 4.1.3.5.1 Paragraph 3.5.1 (Buried Distribution Plant): All direct buried distribution cables shall be filled core type cables. Refer to REA PE-39 for physical and electrical parameters.
- 4.1.3.6 Paragraph 3.6 (Aerial Cable): Aerial type cable construction shall not be used except for temporary services. Exceptions to this requirement must be approved in writing by the Saudi Aramco, IT - Communications Engineering Division, Outside Plant Unit Supervisor.
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- 4.1.4 Digital Connectivity Capability (DCC): (Addition) Future related Integrated Services Digital Network (ISDN) services over fiber or copper cable. Refer to GTE 832 Series for Transmission Loop Design Considerations.
- 4.1.4.1 Paragraph 4.1 (Introduction): Distribution cable design is crucial to digital connectivity capability (DCC). Distribution designs will provide DCC in most applications. Exceptions will primarily be in areas, where loading is required. This section details aspects of distribution cabling that affect DCC.
- 4.1.4.2 Paragraph 4.3 (Bridge Tap Limitations): All cable pairs which are planned for use as digital connectivity pairs must be dedicated cable pairs which are multiple-free, and dedicated to an addressable location. All dedicated pairs are terminated and the field side cut dead ahead at the serving terminal.
- 4.1.4.3 Paragraph 4.6 (Protection Bonding and Grounding): The Design Engineer shall review the existing distribution plant where construction activity is to take place (in pedestals and manholes where splicing, transfers, removal or placement of cable occurs), to ensure that the cable electrical protection devices and the bonding and grounding of cable sheaths meet current Saudi Aramco Standards. This activity is to include the physical inspection and testing of made ground electrodes. All non-complying items must be corrected. This is to include electrical protection devices, grounding, and bonding systems with in existing buildings. The requirements of this paragraph apply to all projects and work orders.
- 4.1.4.4 Paragraph 4.7 (Party Line Grouping): Each station on an existing party line shall be provided its own cable pair, when work is done in its distribution cable legs, to allow grouping at the central office main frame. An alternative is to provide private line service if the necessary equipment is available.
- 4.1.5 Conventional Design
- 4.1.5.1 Paragraph 5.1 (Introduction): Conventional Distribution design is the design to implement for all applications that do not meet Facility Area Plan (FAP) or Rural Distribution Area Plan (RDAP) application parameters.
- 4.1.5.2 Paragraph 5.2 (Design Application) There are three (3) different types of distribution plant within Conventional Design:
- Multiple Outside Plant (OSP) design (MOP).
 - Dedicated Outside Plant (OSP) design (DOP).
 - Interfaced Outside Plant (OSP) design (i.e., Cross-Connected).
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If the feeder cable network functionality goes directly to a customer location, this is defined as Direct Fed Design (DFD).

- 4.1.5.2.1 Paragraph 5.2.1 (Multiple OSP Design): Multiple OSP design (MOP) is where wire center cable counts (feeder counts) appear in more than one (i.e., "multiple") leg of distribution cable through spliced connections. Multiple design creates bridge tap conditions, which degrade transmission characteristics and adversely affect operational aspects of the network. Multiple cable counts shall not be permitted in new construction.
- 4.1.5.2.2 Paragraph 5.2.2 (Dedicated OSP Design): Dedicated OSP design (DOP) is where wire center cable counts (feeder counts), which appear through spliced connections, do not appear in more than one terminal or one leg of distribution cable. This has improved operational and transmission characteristics but has limited accessibility throughout the network.
- 4.1.5.2.3 Paragraph 5.2.3 (Interfaced OSP Design): Interfaced OSP design (i.e., Cross-Connected) refers to plant designed with an interface (e.g., cross-connect or facility area connector) distinguishing feeder/distribution functionality. Overall connectivity from the wire center to the customer is established by jumpering between the feeder and distribution cable counts. This design is similar to FAP/RDAP except overall land usage is not known. The Saudi Aramco IT - Communication Engineering Division, Outside Plant Unit Supervisor, must approve use of this design method in writing.
- 4.1.6 Paragraph 5.7 (Determining cable size): The Saudi Aramco IT - Communication Engineering Division, Outside Plant Unit should determine the distribution cable size needed based on their evaluation of future pair requirements and the outside plant network. Additionally, reinforcement for distribution cable shall be provided for, when the demand or usage of cable pairs results in Eighty Five (85) percent or higher fill by work orders or project job orders. In such cases, the work order or project job order shall be responsible for providing the cable reinforcement.
- 4.1.6.1 Paragraph 5.8: Distribution cables shall not be tapered in size until the cable size can be reduced at the taper by 50%. The Saudi Aramco IT - Communications Engineering Division, Outside Plant Unit Supervisor, must approve exceptions to this in writing.
- 4.1.6.2 Paragraph 6.1 (Determining Gauge of Conductors): Gauge and distribute conductors in distribution plant according to Resistance Engineered to Measured Limits (REML) transmission design procedures.

Commentary Note:

These procedures are outlined in GTE Sections 832-100-072 and [SAES-T-938](#), paragraph 4.3.

4.1.7 Terminals

4.1.7.1 Paragraph 7.3 (Terminal Count): The count of terminals must be contained within a 50-pair group. Multiplying of terminal counts shall not be permitted in new cables. When cable re-arrangements are done, cable and terminal multiples on existing facilities must be eliminated at all work locations. This is not intended to include changing cable and terminal multiples on all cable legs, which change count as a result of re-arrangements at another work location.

4.1.7.2 Paragraph 7.5 (Cable End Point): Where a future extension is not possible, clear and cap the cable at the last service requirement.

4.1.7.3 Paragraph 7.6 (Combination Trunk and Exchange Cable): Combining direct, tandem, or other trunks in the same cable sheath with exchange facilities is not permitted.

4.2 GTE Section 914-100-071: Fixed Count Terminals Engineering Applications Issue 3, November 1985

4.2.1 General

4.2.1.1 Page 1 – Introduction: This section provides engineering information on using fixed count terminals.

Existing multiple terminal counts are to be eliminated as the following design concepts are established:

- Digital Connectivity Capability (DCC).
- Facility Areas.
- Rural Distribution Areas.

4.2.2 Considerations

4.2.2.1 Page 3 – Hardware: Use fixed count terminals on all new routine and specific work order construction. Standard symbols will be shown on work order drawings in accordance with [SAES-T-018](#), Telecommunications - Symbols, Abbreviations and Definitions.

4.2.2.2 Page 4 - Providing Digital Connectivity: Design all new distribution cables and fixed count terminals with the ability to provide connectivity as follows:

- All cable pairs are multiple free and dedicated from the CO connector to the terminal point.
- 4.2.2.3 Page 4 - Converting to Fixed Count Design: In addition to new construction, existing ready-access plant if encountered on a project or job shall be converted to fixed-count design at all work locations.
- 4.2.2.4 Page 4 - Multipling Objectives: It is intended that multipling of cable pairs be eliminated in all of the Saudi Aramco Cable Network. Carefully consider the following objectives:
- Conform to ultimate relief plans by terminating all cable pairs within the limits of the ultimate area to be served by a section of cable.
 - Distribute ultimate loads as evenly as possible throughout the cable.
 - Avoid early congestion of any one terminal or cable pair count.
 - Permit clear, concise records, thus simplifying engineering and assignment work.
 - Facilitate splicing, fault locating, and clearing trouble.

V Installation

Telecommunication distribution cables shall be placed in such a manner as to avoid damaging the outer sheath, shield, and/or the conductors contained within the sheath. All installations shall comply with this standard and other applicable standards as referenced in paragraph 3 above.

VI Testing and Inspection

After installation, all cables shall be tested in accordance with [SAES-T-634](#) using approved testing apparatus. The Saudi Aramco, Inspection Department must be notified two days in advance of testing schedule. Copies of all approved design variations (items for which the Saudi Aramco, IT - Communications Engineering Division, Outside Plant Unit Supervisor is given design variation approval authority in this document) must be provided to the Inspection Department.

Revision Summary

28 January, 2004

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