



# Engineering Standard

SAES-T-625

28 April 2012

Inter and Intra Building  
Fiber Optic Communication Cables

Document Responsibility: Communications Standards Committee

## Saudi Aramco DeskTop Standards

### Table of Contents

1	Scope.....	<a href="#">2</a>
2	Conflicts and Deviations.....	<a href="#">2</a>
3	References.....	<a href="#">2</a>
4	Basic Design Requirements.....	<a href="#">4</a>
5	Other Design Considerations.....	<a href="#">6</a>
6	Installation.....	<a href="#">7</a>
7	Testing and Inspection.....	<a href="#">7</a>

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Page 1 of 8

## 1 Scope

This Standard prescribes Mandatory Requirements for Multimode Fiber Optic Cable parameters associated with On-premises inter-building and intra-building installations for all Data communications and Local Area Network applications. Other applications like PBXs, video and various multiplexing uses for short-length links may also be supported by this standard.

The multimode fiber optic cable parameters as specified in this standard are applicable for transmission speed up to 155 megabits per second (Mbps) for distances up to 2 km (OM1), transmission speed up to 1Gigabit per second (Gbps) for distances up to 550 m (OM2) or transmission speed up to 10 Gigabit per second (Gbps) for distances up to 300m (OM3) only. For higher speeds and longer distances, singlemode fiber optic cables shall be used.

## 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 apply with the latest edition of the references listed below, unless otherwise noted.

### 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-O-100](#)

*General Requirements, Safety and Security*

[SAES-T-624](#)

*Telecommunications; Outside Plant-Fiber Optics*

[SAES-T-634](#)

*Telecommunications; Cable Testing and  
Acceptance*

[SAES-T-916](#)

*Communications; Building Cable*

### 3.2 Industry Codes and Standards

#### International Telecommunications Union – Telecommunications Standardization Sector (ITU-T)

*G.652*                      *Characteristics of a Single-Mode Optical Fiber  
Cable*

*G.653*                      *Characteristics of a Dispersion-Shifted Single-  
Mode Optical Fiber Cable*

*G.655*                      *Characteristics of a Non-zero Dispersion Shifted  
Single-Mode Optical Fiber Cable*

#### American National Standard Institute

*ANSI C2*                      *National Electrical Safety Code (NESC)*

#### Electronic Industries Association

*EIA/TIA-492*                      *Detail Specification for 62.5/125 micron Class Ia  
Multimode, Graded-Index Optical Waveguide  
Fiber*

*EIA/TIA-492A*                      *Sectional Specification for Class Ia Multimode,  
Graded-Index Optical Waveguide Fiber*

*EIA/RS-455*                      *Standard Test Procedures for Fiber Series Optic  
Fiber, Cables, and Addendum (as referenced in  
this standard)*

#### National Electrical Code (NEC) – 2008 Edition

#### National Fire Code (NFC)

#### Rural Electrification Administration

*REA PE-90*                      *Specification for Filled Fiber Optic Cable (as  
referenced in this standard)*

#### Telecommunications Distribution Methods Manual (TDMM) of the Building Industry Consulting Service International (BICSI)

### 3.3 Other References

#### Saudi Arabian Government Safety and Security Directive

*SSD/12*                      *Communications*

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## 4 Basic Design Requirements

- 4.1 All fiber optic cables for inter-building (campus) and intra-building (building distribution system - riser and plenum applications) shall be;

SINGLE-MODE OPTICAL FIBER (Dispersion-Shifted or Non-Zero Dispersion-Shifted) - (In accordance with applicable ITU-T-652, 653, 655)

Or

62.5  $\mu\text{m}$  (core)/125  $\mu\text{m}$  (cladding) MULTIMODE, GRADED-INDEX OPTICAL WAVEGUIDE FIBER (In accordance with applicable EIA/TIA-455 series)

Or

50  $\mu\text{m}$  (core)/125  $\mu\text{m}$  (cladding), MULTIMODE, GRADED-INDEX OPTICAL WAVEGUIDE FIBER (In accordance with the latest version of ITU-T G.651)

*Commentary Note:*

*Per Saudi Aramco IT best practice, it is highly recommended to use:*

- *Single Mode OS1 Fiber (ITU-T G.652.D) for Inter-building (campus) connectivity.*
- *OM3 (50 $\mu\text{m}$ ) laser optimized fiber and/or Single Mode OS1 Fiber (ITU-T G.652.D for intra-building backbone.*

The optical fibers shall consist of a solid glass cylindrical core and cladding covered by Ultra Violet (UV) acrylate or equivalent coating.

All fiber optic cables installed as wiring within buildings shall be air core, Optical Fiber Non conductive Plenum (OFNP) or Optical Fiber Non conductive Riser (OFNR) type with or without non metallic moisture barrier and shall be listed as being suitable for the purpose, listed as being resistant to spread of fire in accordance with the NEC article 770 Section 770-26, installed in accordance with Section 770-110, and marked in accordance with Table 770-179.

Inter-building or entrance fiber optic cables shall be either air core or Polyethylene sheath filled cables with or without metallic moisture barrier. All filled cables and cables with metallic strength member or moisture barrier, shall be terminated and grounded in accordance with the NEC codes.

- 4.2 The multimode fiber cores shall have graded (parabolic) refractive index profiles with CORE DIAMETERS of  $62.5 \pm 3.0$  micrometers when measured in accordance with either

EIA/TIA-455-58A, or EIA-455-176.

The core non-circularity of fibers shall not exceed 6% when measured in accordance with either

EIA-455-45A or EIA-455-176.

- 4.3 The CLADDING DIAMETER of the glass fiber shall be  $125.0 \pm 2.0$  micrometers when measured in accordance with any one of the following test methods:

EIA-455-45A; EIA-455-176; or

EIA/TIA-455-48B, Method A or B

The cladding diameter of the fiber shall be nominally concentric with the fiber core. The cladding concentricity error shall not exceed 6% when measured in accordance with

EIA-455-45A.

The cladding Non-circularity shall not exceed 2% when measured in accordance with either

EIA-455-45A or EIA-455-48B.

- 4.4 The Numerical Aperture of the fiber shall be  $0.275 \pm 0.015$  when measured in accordance with

EIA/TIA-455-177.

- 4.5 The Attenuation of the fibers within the cable shall not exceed 4 dB/km at 850 nanometers and 1.5 dB/kilometer at 1300 nanometers when measured in accordance with any one of the following test methods:

EIA/TIA-455-46A; EIA/TIA-455-53A; or EIA/TIA-455-61.

Attenuation discontinuities in the fiber's length shall not exceed 0.2 dB at  $1300 \pm 20$  nanometers when measured in accordance with

EIA/TIA-455-59.

Measurement of the attenuation shall be conducted at the wavelength specified for application and must be expressed in dB/km.

- 4.6 The minimum Bandwidth of the fiber cable shall be 160 MHz-km @ 850 nanometers and 500 MHz-km @ 1300 nanometers when measured in accordance with either  
  
EIA-455-30A or EIA RS-455-51.
- 4.7 The optical fibers shall be coated with one or more plastic materials or compositions to preserve the intrinsic strength of the glass. The COATING DIAMETER shall be at least  $250.0 \pm 15.0$  micrometers when measured in accordance with either  
  
EIA/TIA-455-55A or EIA-455-173.
- The coating concentricity error shall not exceed 16% when measured in accordance with  
  
EIA-455-55A.

## 5 Other Design Considerations

- 5.1 The Microbending attenuation of the fiber shall not exceed 0.30 dB when measured at  $1300 \pm 20$  nanometers when measured in accordance with  
  
EIA-455-37 and EIA-455-62.
- 5.2 The individual fiber shall withstand tensile stress of minimum 0.35 gigapascal (50 kpsi) for approximately one second when measured in accordance with  
  
EIA/TIA-455-31B.
- 5.3 The maximum force required to remove 25 mm of protective fiber coating shall not exceed 13 newtons when measured in accordance with  
  
EIA/TIA-455-178.
- 5.4 The color designations for Fiber and Buffer Tube identification shall be in accordance with  
  
REA PE-90, section-4.
- 5.5 The outer cable jacket shall be marked at regular intervals (not to exceed 2 m) with the following information:
- a) As required by NEC Article-770 (Table-770-179)
  - b) Name of Manufacturer

- c) Year of Manufacture
- d) Number of Fibers in the cable
- e) Sequentially numbered length markers in meters

## 6 Installation

The installation of all Fiber Optic Cables for Inter and Intra-building applications covered by this standard shall comply with this standard, [SAES-O-100](#) (General Requirements, Safety and Security), [SAES-T-916](#) (Communications Building Cable), the Telecommunications Distribution Methods Manual (TDMM) of the Building Industry Consulting Service International (BICSI), the National Electrical Code (NEC), and SSD/12.

## 7 Testing and Inspection

Test data shall be provided by the manufacturer for each purchases order of fiber optic cables, complying with the following REA PE-90 specifications;

Outer Jacket - section 13

Cable Bend Test - section 18

Cable Impact Test - section 19

Cable Compression Test - section 20

Cable Twist Test - section 21

Cable Flex Test - section 22

Water Penetration Test - section 23 (filled cables only)

Compound Flow Test - section 24 (filled cables only)

In addition to the test data provided by the manufacturer, the Fiber Optic Cables shall be tested for fiber continuity (end to end) and for splice loss as dictated in [SAES-T-624](#) and [SAES-T-634](#).

Cable pulling tensions and bending radii shall be monitored and maintained within the limits specified in [SAES-T-624](#).

Acceptance testing shall confirm that the installation facility meets its design and specified transmission loss criterion as dictated in [SAES-T-634](#).

All cables shall be visually inspected before, during and after installation for physical damage to the cable in accordance with Saudi Aramco inspection procedures. All damaged sections shall be repaired or replaced as directed by the Saudi Aramco representative.

#### **Revision Summary**

2 June 2009	Minor revision to include the 50/125 $\mu$ m multimode fiber, correct NEC referenced tables and revised the "Next Planned Update".
28 April 2012	Editorial revision to change the primary contact.