Fiber Optics Installer (FOI)

Duration: 5 Days   Course Code: FOI

Overview:

A Fiber Optics Installer has a general understanding of optical fiber installation, connectorization, splicing, and testing, is familiar with optical fiber, connector, and splice performance characteristics described in TIA/EIA-568B, ITU-T G.671, ITU-T G.652 and Telcordia GR-326 A Fiber Optic Installer can perform connector endface evaluation as described in TIA/EIA-455-57B, is proficient in optical loss testing as described in TIA/EIA-526-14A, and understands the installation requirements described in articles 770 and 250 of the National Electrical Code. A Fiber Optic Installer is proficient at the installation of connectors on various types' fiber of optic cables using various types of epoxies, and can perform mechanical and fusion splicing. Fiber Optic Installers are expected to obtain knowledge of basic concepts of fiber optics installation and service which are applicable to all the functions required to safely and competently install fiber optics communications cabling. Once a CFOI has acquired these skills, abilities, and knowledge, he or she should be able to enter employment in the telecommunications cabling field. With minimal training in areas unique to the special requirements of individual products or systems designs, the Fiber Optics Installer should become a profitable and efficient part of the workforce

Target Audience:

The FOI program is designed for anyone who is interested in learning how to become a fiber optic installer.

Objectives:

- The Certified Fiber Optic Installer (CFOI) Exam is designed to measure your ability to comprehend and define fundamental fiber optic systems and components.

Prerequisites:

The ETA FOI certification requires no prerequisite

Testing and Certification

To get certified you need to:

1. Complete the Certified Fiber Optic Installer Training (TR-CFI) Course
2. Pass ETA Written + Hands-on Exam (FOI)

Content:

1.0 HISTORY OF FIBER OPTICS AND BROADBAND ACCESS

1.1 Trace the evolution of light in communications
1.2 Summarize the evolution of optical fiber manufacturing technology
1.3 Track the evolution of optical fiber integration and application
1.4 Describe the role of fiber optics in high-speed Internet access

2.0 PRINCIPLES OF FIBER OPTIC TRANSMISSION

2.1 Describe the basic parts of a fiber-optic link
2.2 Describe the basic operation of a fiber-optic transmitter
2.3 Describe the basic operation of a fiber-optic receiver
2.4 Explain how to express gain and loss using the decibel (dB)
2.5 Explain how to express optical power in dBm (measured power referenced to one milliwatt)

3.0 BASIC PRINCIPLES OF LIGHT

3.1 Describe light as electromagnetic energy
3.2 Describe light as particles and waves
3.3 Describe the electromagnetic spectrum and locate light frequencies (wavelengths) within the spectrum in relation to radio and microwave communication frequencies
3.4 Describe the refraction of light
3.5 Explain how the index of refraction is used to express the speed of light through a transparent medium
3.6 Explain reflection to include angle of incidence, critical angle, angle of refraction, and total internal reflection
3.7 Explain Snell's law and its use to calculate the critical angle of incidence
3.8 Explain Fresnel reflections and how they impact the performance of a fiber optic communication system

4.0 OPTICAL FIBER CONSTRUCTION AND THEORY

4.1 Describe the basic parts of an optical fiber
4.2 List the major standards organizations that publish standards that define the performance of optical fibers used in the telecommunications industry
4.3 List the different materials that can be used to construct an optical fiber
4.4 Describe the tensile strength of an optical fiber
4.5 Describe optical fiber manufacturing techniques
4.6 Describe mode in an optical fiber
4.7 Describe how the number of modes in an optical fiber is defined by core diameter and wavelength
4.8 Describe the refractive index profiles commonly found in optical fiber
4.9 Explain the propagation of light through a multimode step index optical fiber
4.10 Explain the propagation of light through a multimode graded index optical fiber
4.11 Explain the propagation of light through a single-mode optical fiber
4.12 Describe the location and function of an optical trench
4.13 Describe the advantages of single-mode and multimode bend insensitive optical fiber

5.0 OPTICAL FIBER CHARACTERISTICS

.1 Describe dispersion in an optical fiber
5.2 Describe modal dispersion and its effects on the bandwidth of an optical fiber
5.3 Describe material dispersion and its effects on the bandwidth of an optical fiber
5.4 Explain waveguide dispersion in a single-mode optical fiber.
5.5 Explain chromatic dispersion in an optical fiber
5.6 Explain polarization mode dispersion in a single-mode optical fiber
5.7 Describe how dispersion affects bandwidth in an optical fiber
5.8 Describe the causes of attenuation in an optical fiber
5.9 Describe attenuation versus wavelength in an optical fiber
5.10 Describe a microbend in an optical fiber
5.11 Describe a macrobend in an optical fiber
5.12 Explain the difference between a bend sensitive and bend insensitive single-mode optical fiber
5.13 Explain the difference between a bend sensitive and bend insensitive multimode optical fiber
5.14 Describe the numerical aperture of an optical fiber
5.15 Explain how optical fibers are designated in ISO/IEC 11801
5.16 Explain how optical fibers are designated in IEC 60793-2-10 and IEC 60793-2-50
5.17 Describe how optical fibers are designated in ANSI/TIA-568-
5.18 Describe how the International Telecommunications Union (ITU) designates optical fibers
5.19 Describe the performance characteristics of ANSI/TIA-568- and ISO/IEC 11801-recognized optical fibers
5.20 Describe the performance characteristics of ITU-T G.652, ITU-T G.655, and ITU-T G.657 single-mode optical fibers
5.21 Describe the attenuation and bandwidth characteristics of HCS/PCS (Hard Clad Silica/Plastic Clad Silica) and plastic optical fibers

6.0 FIBER OPTIC SAFETY

6.1 Cite the government agency that publishes and enforces regulations on safety in the workplace
6.2 Explain how to safely handle and dispose of fiber optic cable and bare optical fiber
6.3 List the laser hazard classifications of fiber optic light sources and describe the dangers associated with each
6.4 Describe potential chemical hazards in the fiber optic environment and explain the purpose of the material safety data sheet (MSDS or SDS)
6.5 Describe potential electrical hazards in the fiber optic installation environment
6.6 Describe typical work place hazards in the fiber optic environment

7.0 FIBER OPTIC CABLES

7.1 Explain the purpose of each component displayed in a cross section view of a fiber optic cable
7.2 Explain why and where loose buffer fiber optic cable is used
7.3 Describe the difference between gel-filled and gel-free loose buffer fiber optic cables
7.4 Describe tight buffer fiber optic cable
7.5 Compare common strength members found in fiber optic cables
7.6 Name common jacket materials found in fiber optic cables
7.7 Describe simplex and duplex cordage and explain the difference between cordage and cable
7.8 Describe the characteristics of the following:
7.8.1 Distribution cable
7.8.2 Breakout cable
7.8.3 Armored cable
7.8.4 Messenger cable
7.8.5 Ribbon cable
7.8.6 Submarine cable
7.8.7 Hybrid cable
7.8.8 Composite cable
7.9 Explain how and when a fan-out kit is used
7.10 Explain how and when a breakout kit is used
7.11 Describe the National Electrical Code (NEC) fiber-optic cable types
7.12 Describe the NEC listing requirements for fiber-optic cables
7.13 Explain the difference between a listed and nonlisted fiber-optic cable
7.14 List the types of markings typically found on the jacket of a fiber-optic cable
7.15 Describe the TIA-598- color-coding scheme for individual fibers bundled in a fiber-optic cable
7.16 Describe the TIA-598- color-coding scheme for premises cable jackets
7.17 Explain how numbering is used to identify the individual fibers bundled in a fiber-optic cable
7.18 Describe how to use sequential markings to determine fiber-optic cable length

Content:

8.0 SPLICING

8.1 Describe the intrinsic factors that affect splice performance

8.2 Describe the extrinsic factors that affect splice performance

8.3 Explain how a mechanical splice creates a low loss interconnection

8.4 Describe how to assemble a mechanical splice

8.5 Explain how a fusion splicer creates a low loss interconnection

8.6 Describe the basic operation of a fusion splicer

8.7 Describe the different alignment techniques that can be used to align the optical fibers

8.8 Explain how to assemble and protect a fusion splice

8.9 List the ANSI/TIA-568- inside plant splice performance requirements

8.10 List ANSI/TIA-758- and Telcordia GR-20 outside plant splice performance requirements

8.11 Describe the Telcordia GR-765 required and objective fusion splice insertion loss requirements for passive and active alignment splicers

9.0 CONNECTORS

9.1 Describe the basic components of a fiber optic connector

9.2 Describe common connector ferrule materials

9.3 List the intrinsic factors that affect connector performance

9.4 List the extrinsic factors that affect connector performance

9.5 Describe the following endface geometries:

9.5.1 Flat

9.5.2 Curved

9.5.3 Angled

9.5.4 Lensed

9.6 Describe return or back reflections, return loss, and reflectance in an interconnection

9.7 Explain how endface geometry affects return loss and reflectance

9.8 Describe how an interferometer is used in the evaluation of endface geometry

9.9 Describe the following critical parameters that are required by Telcordia GR-326 to evaluate connector endface geometry for single-mode connectors and jumper assemblies:

9.9.1 Radius of curvature

9.9.2 Apex offset

9.9.3 Fiber undercut or protrusion

9.10 Explain the difference between a contact and noncontact connector

9.11 Describe the ANSI/TIA-568- recognized connectors

9.12 Describe small form factor connectors

9.13 Describe MPO connectors

9.14 Describe a pigtail and the potential advantages it offers over field terminations

9.15 Describe the steps involved in an oven cured epoxy connector termination and polish

9.16 Describe the steps involved in an anaerobic epoxy connector termination and polish

9.17 Explain how machine polishing produces a better, more consistent endface than hand polishing

9.18 Describe pre-polished connector termination techniques

9.19 Explain how to properly clean a connector endface using dry cleaning techniques

9.20 Explain how to properly clean a connector endface using wet-dry cleaning techniques

9.21 Explain how to examine the endface of a connector per ANSI/TIA-455-57- and IEC 61300-3-35

9.22 List the ANSI/TIA-568- maximum insertion and return loss values for multimode and single-mode mated connector pairs

9.23 List the ITU-T G.671 maximum insertion loss and reflectance values for single-mode single-fiber mated connector pairs

9.24 Explain how to use the ANSI/TIA-568- color code to identify multimode and single-mode connectors and adapters

10.0 FIBER OPTIC LIGHT SOURCES

10.1 Describe the basic operation and types of LED light sources used in fiber optic communications

10.2 Describe the basic operation and types of laser light sources used in fiber optic communications

10.3 Describe LED performance characteristics

10.4 Describe laser performance characteristics

10.5 Describe the performance characteristics of an LED transmitter

10.6 Describe the performance characteristics of a laser transmitter

10.7 Explain the difference between a serial and parallel laser transmitter

10.8 Describe the laser types and wavelengths associated with serial and parallel laser transmitters

10.9 Describe the optical fiber types associated with VCSEL (Vertical Cavity Surface Emitting Laser) serial and parallel laser transmitters

10.10 Explain the safety classifications of the light sources used in fiber optic communication

11.0 FIBER OPTIC DETECTORS AND RECEIVERS

11.1 Describe the basic operation of a photodiode

11.2 Describe the basic components in a fiber optic receiver

11.3 Explain dynamic range and operating wavelength

11.4 Explain why an optical attenuator may be used in a communication system

12.0 CABLE INSTALLATION AND HARDWARE

12.1 Explain manufacturer installation cable specifications

12.2 Discuss ANSI/TIA-568- performance specifications for the optical fiber cables recognized in premises cabling standards to include:

12.2.1 Inside plant cable

12.2.2 Indoor-outdoor cable

12.2.3 Outside plant cable

12.2.4 Drop cable

12.3 Explain the static and dynamic loading on a fiber optic cable during installation

12.4 Describe commonly used installation hardware

12.5 Summarize the following types of preparation:

12.5.1 Patch panel

12.5.2 Racks and cable

12.5.3 Splice enclosure

12.6 Describe the following types of installations:

12.6.1 Tray and duct

12.6.2 Conduit

12.6.3 Direct burial

12.6.4 Aerial

12.6.5 Blown fiber

12.6.6 Wall plate

12.7 Describe the permitted locations defined in NEC Article 770 for the following cables:

12.7.1 Plenum

12.7.2 Riser

12.7.3 General-purpose

12.7.4 Unlisted conductive and nonconductive outside plant cables

12.8 Describe the NEC fiber-optic cable types that might require grounding or isolation.

12.9 Explain entrance cable bonding and grounding per NEC Articles 250, 770.93, and 770.100

12.10 Recognize that ANSI/TIA-606- concisely describes the administrative record keeping elements of a modern telecommunications infrastructure

12.11 Explain that the administration includes basic documentation and the timely updating of drawings, labels, and records

12.12 Explain why proper polarity is required to ensure the operation of bidirectional fiber optic communication systems

12.13 Explain the roles of the following:

12.13.1 National Electrical Code (NEC)

12.13.2 Canadian Electrical Code (CEC)

12.13.3 National Electrical Safety Code (NESC)

13.0 FIBER OPTIC SYSTEM ADVANTAGES

13.1 Compare the bandwidth advantages of optical fiber over twisted pair and coaxial copper cables

13.2 Compare the attenuation advantages of optical fiber over twisted pair and coaxial copper cables

13.3 Explain the electromagnetic immunity advantages of fiber optic cable over copper cable

13.4 Describe the size advantages of fiber optic cable over copper cable

13.5 Describe the weight-saving advantages of fiber optic cable over copper cable

13.6 Describe the security advantages of fiber optic cable over copper cable

13.7 Compare the safety advantages of fiber optic cables over copper cables

14.0 TEST EQUIPMENT AND LINK/CABLE TESTING

14.1 Explain why test equipment calibration should be traceable to the National Institute of Standards and Technology (NIST) calibration standard

14.2 Describe the types of fiber optic test equipment that can be used to test for continuity

14.3 Explain the use of a visual fault locator (VFL) when troubleshooting a fiber span

14.4 Describe the basic operation of a multimode and single-mode optical loss test set (OLTS)

14.5 Explain the difference between a patch cord and a measurement quality jumper (MQJ)

14.6 Define the purpose of a mode filter

14.7 Explain why five small-radius nonoverlapping loops around a mandrel may be required on the transmit jumper when measuring multimode link attenuation in accordance with ANSI/TIA-526-14-A

14.6 Define the purpose of a mode filter

14.7 Explain why five small-radius nonoverlapping loops around a mandrel may be required on the transmit jumper when measuring multimode link attenuation in accordance with ANSI/TIA-526-14-A

14.8 Explain why a single turn 30mm in diameter loop must be applied to the transmit jumper when measuring single-mode link attenuation in accordance with ANSI/TIA-526-7

14.9 Explain why the encircled flux requirement was developed for multimode link attenuation measurements

14.10 Explain why multimode insertion loss measurements being performed in accordance with ANSI/TIA-526-14- require a modal controller on the transmit jumper

14.11 Describe how to measure the optical loss in a patch cord with an OLTS using the steps described in ANSI/TIA-526-14, method A, two-test jumper reference

14.12 Summarize the basic operation of an optical time domain reflectometer (OTDR)

14.13 Describe the required Tier 1 Testing tasks and equipment

14.14 Describe the required Tier 2 Testing tasks and equipment