Fiber Optics Technician (Outside Plant)– FOT-OSP

1.0 PRINCIPLES OF LIGHT AND FIBER OPTIC TRANSMISSION THEORY

1.1 List the types of light sources used in singlemode systems
1.2 Describe common transmission wavelengths used in singlemode systems
1.3 List the wavelengths used in FTTH/PON systems
1.4 Explain how optical power levels are measured (dBm)
1.5 List the types of optical reflections
1.6 Explain Index of Refraction
1.7 List the causes of Fresnel reflections
1.8 Describe the wavelength (or frequency) bands used in Dense Wavelength Division Multiplexing (DWDM) systems

2.0 SINGLEMODE FIBER, CHARACTERISTICS, CONSTRUCTION & THEORY

2.1 Describe an ITU-T G.652 singlemode fiber
2.2 Describe an ITU-T G.655 singlemode fiber
2.3 Describe the light transmission area for singlemode fiber operation
2.4 Explain the purpose of a fiber's cladding
2.5 Describe the two common coating diameters used in singlemode fibers
2.6 Describe how different manufacturing techniques can affect system performance
2.7 Describe 'chromatic dispersion'
2.8 Describe 'material dispersion'
2.9 Describe 'waveguide dispersion'
2.10 Describe the term 'optical windows'
2.11 Describe 'optical bands'
2.12 Describe the term 'microbending'
2.13 Describe the term 'macrobending' and compare it with microbending
2.14 Identify the standard tensile strength load value for singlemode fiber optic cable

3.0 TERMINOLOGY, DEFINITIONS AND ABBREVIATIONS USED IN OSP FIBER OPTICS

3.1 Define:
- 3.1.1 ITU
- 3.1.2 FTTH/PON
- 3.1.3 LAN, WAN and MAN
- 3.1.4 WIC coupler
- 3.1.5 FOTP (Fiber Optic Test Procedure)
- 3.1.6 ODN and OSP
- 3.1.7 MSDS
- 3.1.8 FDU
- 3.1.9 FDH

4.0 SINGLEMODE FIBERS IN WAN, MAN, FTTx and Premises NETWORKS

4.1 List the types of singlemode fiber used in premises applications
4.2 Describe acceptable methods of terminating singlemode fiber
4.3 List the types of fiber used in metropolitan area networks (MANs)
4.4 Describe the type of fiber used for DWDM applications
4.5 List the ITU specification for the two common singlemode fiber types
4.6 Compare different techniques used in fiber manufacturing
4.7 List different types of fiber optic cable tolerances
4.8 List the fiber type specified in the ITU standard for FTTH
4.9 Describe the different types of dispersion in singlemode applications

5.0 FIBER OPTIC CABLES

5.1 In a cross-section drawing of a stranded fiber optic cable, explain the purposes of each segment
5.2 Identify the segments in the drawing of a cross section of a central tube fiber optic cable
5.3 Explain why and where loose tube cable is used
5.4 Compare tight-buffered cable with other types of fiber cable
5.5 Explain the differences between the strength member in both stranded and central tube fiber optic cables
5.6 Name the cable jacket material used in common types of outside plant cables
5.7 Explain the purpose of installation specifications
5.8 Define distribution cable structure and compare it with loose tube and central tube fiber optic cables
5.9 List reasons for utilizing armored fiber cables
5.10 Describe the purpose of cable ribbons and how they are used in fiber optic cables
5.11 Explain the purpose and indicate where the TIA/EIA-598-B color code is used
5.12 Describe cable markings and how they are used
5.13 Explain the use of sequential cable markings
5.14 Describe the two types of outdoor style cable structures
5.15 Compare indoor and outdoor cables, their applications and benefits
5.16 Describe the use of cable gels, powders and tapes
5.17 Define tensile strength of a fiber cable
5.18 Describe the dynamic load of a fiber cable
5.19 Define ‘static load’ as it refers to fiber cabling
5.20 Describe the detrimental effects of exceeding the minimum dynamic bend radius of a fiber cable
5.21 Compare static versus dynamic bend radius in fiber optic cabling
5.22 Describe the differences between fiber optic trunk, distribution and drop cables
5.23 Define ‘macrobend’ and explain its relevance
5.24 Explain the importance of the attenuation specification in fiber optic cables and how it is used

6.0 LIGHT SOURCES

6.1 Explain the purposes and differences in the safety classifications for light sources used in fiber communications
6.2 Name the type of light source used in OSP (Outside Plant) applications
6.3 List the common wavelengths used in singlemode fiber communications systems and the advantages and disadvantages of each
6.4 Explain how to measure the output power of a light source
6.5 Explain dBm and its role in testing transmit and receive optical power levels
6.6 Explain the impact of Fresnel reflections on laser transmission
6.7 Demonstrate proper cleaning of connectors used with laser light sources

7.0 DETECTORS

7.1 Describe the basic role of the photodiode in fiber optic communications

8.0 CONNE CTORS

8.1 Identify standard fiber optic cable connector types
8.2 Explain intrinsic factors applicable to losses in fiber connectors
8.3 Explain extrinsic factors that cause attenuation in a fiber optic connection
8.4 Describe how interconnection losses can be identified using common measuring equipment
8.5 Explain how reflections can be identified in a completed cable link
8.6 Describe a PC polish
8.7 Describe a UPC polish
8.8 Describe an APC polish
8.9 Describe how and where pigtails are used in fiber optic cabling systems
8.10 List steps taken to properly perform a visual inspection of an optical plug (connector)
8.11 Describe proper cleaning of a singlemode plug and sleeve
8.12 Describe contaminated or damaged connector ferrules
8.13 Name common contaminants found in fiber cabling systems
8.14 Describe common types and causes of fiber damage at the ferrule
8.15 Describe a small form factor (SFF) connector as used in fiber optic cabling

9.0 PASSIVE COMPONENTS

9.1 Explain the uses and benefits as well as disadvantages of using fiber optic signal splitters
9.2 Describe where optical splitters are used in FTTx applications
9.3 Explain wavelength division multiplexing (WDM)
9.4 Explain how wavelength division multiplexing (WDM) is used in fiber to the home/ passive optical networking systems
9.5 Explain the differences between WDM and dense wavelength division multiplexing (DWDM)
9.6 Explain coarse wavelength division multiplexing (CWDM)

9.7 Describe a WIC coupler and its characteristics
9.8 Describe how an insertion loss test is conducted for optical splitters
9.9 List the attenuation values for 1x2, 1x4, 1x16 and 1x32 splitters
9.10 Explain how to test and compare measured versus theoretical losses of splitters
9.11 Explain why an optical attenuator may be required in a fiber optics system

10.0 TYPES OF SPLICING

10.1 Explain the differences between intrinsic factors and extrinsic factors when splicing optical fibers
10.2 List extrinsic factors important in fiber splicing
10.3 Describe correct fiber cable preparation
10.4 Explain the purpose of index matching gel and where it is used
10.5 Explain the benefit of index matching fluids
10.6 Describe ANSI/TIA/EIA-758-A performance specification standards for mechanical and fusion splices
10.7 Explain the purposes of the splice closure
10.8 Describe the correct cleaving operation for a fiber optic splice
10.9 Explain the purpose and the correct method of applying a splice protector
10.10 Describe splice trays and their usage
10.11 Explain the role and benefits of pigtail splices in a singlemode system
10.12 List the two coatings used in singlemode pigtail splicing
10.13 Explain where mechanical splices are used in singlemode systems
10.14 Identify the proper color code sequence for splice tray management

11.0 CABL E INSTALLATION

11.1 Define ‘dynamic tensile loading’ of a fiber optic cable
11.2 Explain ‘static tensile loading’ and compare with dynamic tensile loading
11.3 Compare the dynamic bend radius minimums for common OSP fiber cables
11.4 Describe the effects of exceeding minimum bend radius limitations
11.5 Explain when and where bonding to ground is required
11.6 Describe a pulling grip and explain its usage
11.7 Describe where conduit should be installed to protect fiber optic cables
11.8 Describe the National Electrical Code (Article 770) rules pertaining to cabling
11.9 Describe the role of the NESC for aerial and buried installations
11.10 Explain why a mid-entry into an OSP cable may be required
11.11 Explain the tension ratings of drop and trunk cables
11.12 List the minimum depth for burial of a fiber optic cable drop
11.13 Name cable management products used for cable slack in aerial installations
11.14 Name cable management products used for slack cable in hubs and vaults
11.15 List the maximum tension level for a fiber optic drop cable

12.0 HARDWARE

12.1 Explain common practices for fiber optic splice closures
12.2 Explain the role of the Fiber Distribution Unit (FDU)
12.3 Explain the role of the Fiber Distribution Hub (FDH) in FTTx applications
12.4 Describe how the mid-entry splice cables are routed through a splice enclosure
12.5 Describe the different types of cable management products that are used at the hub locations
12.6 Compare the options for cable routing in a hub location
12.7 Explain the NEC requirement for outdoor cable entry into a building
12.8 List the different types of innerduct products commonly used in fiber optic cabling
12.9 Describe how a loose tube cable is installed and spliced at an entrance cabinet
12.10 Describe the products, applications and options used in the ODN for FTTx installations
12.11 Describe the three installation/termination options for the FTTx drop cables

13.0 FIBER OPTIC LINK

13.1 List the three basic parts of a fiber optics system
13.2 Explain how to prepare a basic optical link power budget
13.3 Explain the purpose of a basic “not to exceed” OSP loss budget
13.4 Explain how to measure the receive power levels of a fiber optics receiver
13.5 Describe how to use an optical attenuator and calculate the proper reduction of signal output light intensity
13.6 Describe the topologies used in MAN applications
13.7 Describe the topology used in an FTTx installation

14.0 OPTICAL FIBER MEASUREMENT AND TESTING

14.1 List the types of attenuation in fiber optics cables
14.2 Explain how to properly use an Optical Loss Test Set
14.3 Explain when 2 KHz modulation of the fiber optic light source would be used
14.4 Explain the proper use of the fiber optic power meter (OPM)
14.5 Describe how to locate a fault using an Optical Time Domain Reflectometer (OTDR)
14.6 Compare fusion and mechanical splice, connector, and splitter signatures when using the OTDR
14.7 Describe a micro/macrobend at a splice closure
14.8 Describe the ‘Fiber Identifier’ and its operation
14.9 Explain how to measure Fresnel reflections at patch panels
14.10 Explain why bi-directional tests are performed
14.11 Explain the reasons for dual wavelength testing
14.12 Explain when to test using a light source and power meter
14.13 Explain what tests the OTDR is used for
14.14 Describe the causes of ghost reflections
14.15 Explain how the fiber optic talk set is used
14.16 Describe when and where the visual laser is commonly used

15.0 LINK AND CABLE TESTING

15.1 Explain why an end-to-end optical loss test is performed
15.2 Describe the transmitter power test using the optical power meter
15.3 Describe the receiver optical power test using the optical power meter
15.4 Explain the purpose of an acceptance test to verify fiber optic cable values using the OTDR
15.5 Explain how an acceptance test for a mechanical splice is made
15.6 Describe the OTDR's 'dead zone'
15.7 Compare fusion and mechanical splice loss requirements per ANSI/TIA/EIA-758-A
15.8 Explain how to measure a fusion splice
15.9 Explain how to find the actual fault location of a non-reflective break
15.10 Explain how to perform a bi-directional test on a fiber span
15.11 Describe documentation of the values of component losses
15.12 Describe how to document the end to end attenuation value of a fiber span.

16.0 SAFETY

16.1 Describe laser classifications (per CDRH – Center for Devices & Radiological Health)
16.2 Describe MSDS (Material Safety Data Sheets) regulations and the OSP products for which they would be required
16.3 Describe basic fiber optic safety practices in regard to eyes, skin and lungs, as well as safe fiber disposal methods
16.4 Describe safe cabling operations when working in confined spaces

End of FOT – OSP Knowledge Competencies