Fiber Optics for Oil & Gas

Detailed Course Outline

Light Brigade®
FIBER OPTIC TRAINING

This four-day class has been developed with 16 hours of classroom lecture and 16 hours of hands-on skills labs to provide practical understanding and skills required to properly design, install and maintain fiber optics systems in petrochemical environments such as offshore drilling, pipeline, refineries, and process plants. Students will use the latest fiber optic technology and equipment to learn how to splice, connectorize, test, and troubleshoot petrochemical-based optical fiber networks.

Prerequisites: None; entry level.

Certifications and Credits: ETA Fiber Optics Installer (FOI) Certification
Light Brigade Digital Credentialing

Fiber Optic Basics

- Fiber optics in oil and gas applications
- Basic fiber optic terminology
- Typical transmission rates
- Advantages and disadvantages of fiber optics
- Standards committees

Optical Theory

- Attenuation
- Refraction and reflection
- Numerical aperture
- Intrinsic and extrinsic losses
- The electromagnetic spectrum
- Lightwave transmission
- Graded-index lightwave propagation
- Step-index fibers
- Multimode system with LED source
- Single-mode system with laser source
- Mode field diameter
- Dispersion

Optical Fibers

- Fiber characteristics
- Fiber coatings
- Multimode bandwidth
- Overfilled versus restricted mode launch
- Multimode fiber types
- Single-mode optical fibers and types
- Fibers for harsh environments
- Application specific optical fibers
- Fiber selection

Cable

- Cable materials and structure
- Indoor optical cables
- Breakout and distribution cables
- Loose tube outside plant cables
- ADSS and OPGW cables
- Fiber rich outdoor cable styles
- Unitube and indoor/outdoor cables
- Low smoke zero halogen cables
- Composite and hybrid cables
- Specialty cables and subcomponents
- Fiber optic cables for sensing
- Oil and field sensing cables
- Metal reinforced cables
- Umbilicals and tethers
- Umbilical cable assemblies
- Fiber optic cable cordage
- Cable interconnection options
- Loose tube cable preparation

Connectors

- Connector components and roles
- Subscriber connectors (SC)

835 N Central Avenue Ste. D-132
Kent WA 98032

1 (206) 575-0404
1 (800) 451-7128

www.lightbrigade.com
learn.lightbrigade.com

- BFOC 2.5 (ST) connectors
- LC connectors
- Multifiber connectors
- Connectors for harsh environments
- Fiber optic rotating joints
- Termination techniques
- Connector polishing and cleaning
- Single-mode field connectorization issues

Splicing

- Good splice requirements
- Fiber cleaving
- Mechanical and fusion splicing
- Polyimide coating strippers
- 4Ribbon splicing technology
- Pigtail splicing
- Splice protection

Cable Management

- Fiber optic interconnect hardware
- Trunk and branch system
- Fiber management
- Panel and closure issues
- Premises panels
- Fiber distribution units
- Fanout and breakout kits
- Splice panels
- Optical entrance enclosures
- Splice tray recommendations
- Splice closures and slack buffer tubes

Installation

- Cable handling
- Standards and regulations
- Proper route planning and engineering
- Direct buried
- Underground installation techniques
- Cable trenching
- Equipment requirements
- Directional boring
- Conduit and duct installation
- Microducts for fiber optic cables
- Cable pulling lubricants and methods
- Tension monitoring
- High air speed blown
- Elements of an ABF network
- Aerial placement
- Aerial cable types
- Typical pole placement
- Aerial installation
- Mid-span (express) entries
- Slack storage methods
- Aerial cable storage products
- Underground cable storage
- Cable trays and cable duct benefits
- Fiber raceway systems
- Cable installation products

Optical Testing

- OTDR signatures and deadzone
- Optical gain
- Fiber roll-off
- Index of refraction
- OTDR acceptance testing
- Brillouin OTDRs
- Optical loss test sets
- Testing transmit and receive power
- Fiber identifiers
- Visual tracers
- Visual inspection and inspection equipment
- Digital video inspection scopes
- Documentation issues
- Sequential markings
- Effective maintenance postures

Sensing Theory

- Fiber Bragg grating sensors
- Mode coupled sensors
- Fiber-based interferometer sensors
- Raman scattering
- Brillouin scattering
- Rayleigh backscatter

Sensing Applications
- Temperature and stress monitoring
- Distributed sensing
- Temperature sensing
- Strain sensing
- Pressure sensing
- Bruillouin sensing
- Acoustic sensing
- Typical temperature monitoring zones

Restoration
- Typical causes of failure
- Types of fiber optic damage
- Frequently encountered problems
- Typical cable system faults
- Equipment used in the restoration role
- Emergency restoration kit requirements
- Aerial restorations
- Outside plant restorations
- OSP emergency restorations
- Premises restorations
- LAN restorations
- Post-restoration recommendations

Safety
- Fiber optic safety concerns
- Visual safety using fiber optic sources
- Working with optical fibers
- Chemicals
- Installation practices

Active Devices
- LED and laser spectral width
- Fabry-Perot lasers
- Distributed feedback lasers
- Vertical cavity surface-emitting lasers
- Light-emitting diodes
- Tunable lasers
- Optical isolators
- Fiber optic receivers
- PIN and avalanche photodiodes
- Electrical modulation techniques
- Optical bidirectional devices
- Diplexers, triplexers, and quadplexers
- Repeaters, regenerators, and amplifiers
- Optical amplification

Passive Devices
- Fiber optic splitters
- Splitter specifications
- Multiplexing light and demultiplexing light
- Fiber Bragg gratings
- Optical switches

System Design
- Design objectives and options
- Wavelength optimization
- Safety margin
- System budgets
- Multimode fiber size compatibility
- Multimode bandwidth
- Calculating dispersion penalty
- Protecting your system
- Planning and scheduling
- Routing
- Design issues for LANs

System Standards
- Wide area networks
- IEEE 802 standards
- Typical Ethernet specifications
- SCADA
- High definition television
- Closed circuit television
- From T-carrier to SONET/SDH
- Asynchronous transfer mode (ATM)

Miscellaneous
- U.S. and Canadian electrical codes
- TIA-569

Hands-on Skills Learning

Fiber Optics for Oil & Gas

Detailed Course Outline

Light Brigade®
FIBER OPTIC TRAINING

Fiber and Cable Preparation
- Mid-cable entry techniques
- Closure and panel preparation

Mechanical and Fusion Splicing
- Fiber cleaning and preparation
- Splicing 250-µm and 900-µm fibers
- Fiber handling and cleaving
- Fusion splicing

Connectorization & Termination
- SC, ST, and LC connectors
- Field-installable connectors
- Factory pigtails
- Connector cleaning and inspection
- Troubleshooting connectors

Optical Loss Testing
- Test Tx and Rx power levels
- Troubleshooting using OLTS, VFIs
- Event loss analysis
- Documentation and records

Optical Time Domain Reflectometers
- OTDR setup and operation
- Reflectance testing
- System acceptance testing
- Splice and span loss testing
- Maintenance and restoration

835 N Central Avenue Ste. D-132
Kent WA 98032

1 (206) 575-0404
1 (800) 451-7128

www.lightbrigade.com
learn.lightbrigade.com