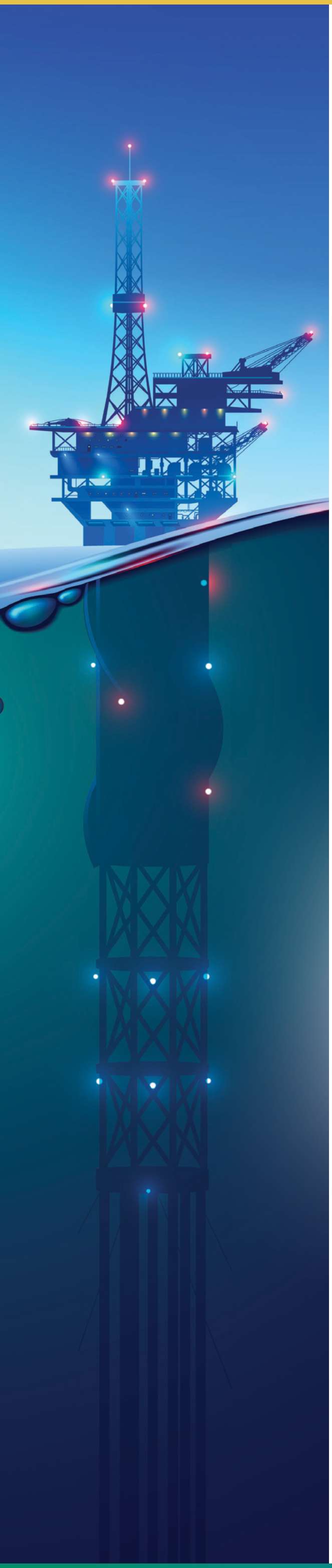
Industrial & Harsh Environments

Foundational



Fiber Optics for Oil/Gas

This four-day instructor-led course teaches how to properly install and maintain fiber optic systems in petrochemical environments. Attendees will learn to splice, connectorize, test, and troubleshoot optical fiber networks to increase efficiency and reliability as well as reduce costs and downtime.

Audience: Those who design, install, test, or maintain fiber networks in petrochemical applications such as offshore drilling, pipelines, refineries, and processing plants

Prerequisite: Fiber Foundations is recommended, but not required.

Credentialing

ETA® International Fiber Optics Installer (FOI)
Valid for four years.

Light Brigade Digital Badge
Complete this course and receive a Credly digital badge.

Click or scan for detailed course information and upcoming training locations.

Fiber Optics for Mining Applications

This four-day instructor-led course teaches proper installation and maintenance of fiber optics systems in harsh underground and surface mine environments. Attendees will learn to splice, connectorize, test, and troubleshoot mining-based optical fiber networks to increase efficiency and reliability.

Audience: Anyone who designs, installs, tests, or maintains optical fiber networks in harsh or hazardous environments

Prerequisite: Fiber Foundations is recommended, but not required.

Credentialing

ETA® International Fiber Optics Installer (FOI)
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Fiber Optics for Mining

Detailed Course Outline

Light Brigade
FIBER OPTIC TRAINING

This four-day class has been developed with two days of classroom lecture and two days of hands-on skills labs to provide the practical understanding and skills required to properly design, install, and maintain fiber optics systems in harsh environment underground and surface mines. Students will use the latest fiber optic technology and equipment to learn how to splice, connectorize, test, and troubleshoot mining-based optical fiber networks in order to increase efficiency, reliability, and to meet on-the-job MSHA safety requirements.

Prerequisites: None; entry level.

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

Communication Basics

- Basic signal communication
- Digital communications
- The binary system
- What is an optical fiber?
- Primary fiber coatings
- Optical fiber color coding
- Basic units of measure in fiber optics
- Advantages of fiber optics
- Standards and codes

Fiber Optic Transmission Theory

- The electromagnetic spectrum
- Fiber optic transmitters and receivers
- Fiber optic loss
- dBm and dB
- Bandwidth
- Attenuation and loss
- Refraction
- Reflection
- Dispersion
- Fiber tolerances

Optical Fibers

- The physical plant
- Fiber comparison
- What is a mode?
- Multimode fiber types
- Single-mode fiber types

Cable

- Cable designs
- MSHA-rated cable designs
- Cable materials and structure
- Common cable jacket materials
- Indoor optical cable ratings
- Ammonium Octamolybdate
- Low smoke zero halogen
- Distribution cables
- Breakout cables
- Tight buffered cable specifications
- Interlocking armor cable
- Standard cable cordage
- Indoor/outdoor cables
- Loose tube outside plant cables
- Stranded cables
- Unitube/central tube cables
- Ribbon cables
- Ultra high density fiber cables
- Microduct cables
- Aerial fiber optic cables
- Drop cables
- Optical cable specifications
- Fiber coating and buffer color codes
- Composite and hybrid cables
- Cable components and elements
- Cable termination

Fiber Optic Connectors

- FOCIS and IEC 61754
- Main connector components
- Typical connector roles
- Causes of excess loss
- SC connectors
- ST connectors
- LC connectors
- Hardened and ruggedized connectors
- TFOCA connectors
- Expanded beam connectors
- MPO connectors
- Termination techniques

Connector Endfaces

- Endface geometry
- Fiber optic connector endface inspection
- Connector inspection criteria
- Reflection issues
- Fiber optic connector polishes

Splicing

- Connectors versus splices
- Splicing considerations
- Anatomy of a fusion splicer
- Splicer cleanliness
- Choosing the correct settings
- Perform regular arc tests
- Splice errors
- Strip tool cleanliness
- Fiber optic cleaving
- Fusion splicing
- Ribbon splicing
- Mechanical splicing
- Pigtail splicing and splice-on connectors
- Splice protection

Fiber and Cable Management

- Good vs. bad cable management
- Patch panels
- Splice panels
- Building entrance terminals
- Fiber distribution units
- Splice closures
- Splice trays
- Flexible splice enclosures
- Fanout and breakout kits
- Building and campus topologies
- Wall-mounted premises panels
- Fiber raceway systems
- Work area outlets
- Fiber to the building installations
- OSP fiber and cable management
- FTTx cable management products
- Fiber distribution hubs
- Fiber access terminals
- Multiport service terminals
- Fiber transition terminals
- Cabling scenarios
- Vaults and handholes
- Panel and closure considerations

Installation

- Optical cable installation
- Deep mine installation
- Cable handling
- General installation guidelines
- Standards, regulations, and codes
- Air blown fiber networks
- Topologies
- Cable trays and ducts
- Cable installation products

OSP Installation

- Proper route planning and engineering
- Underground installation methods
- Conduit and duct installation
- Microducts and multiducts
- Cable pulling
- Air blown fiber
- Aerial installation
- Mid-span (express) entries
- Slack storage methods
- Cable storage
- Sequential markings
- Fiber installation inspection report

Test Equipment
- Optical loss testing
- Optical time-domain reflectometers
- Key considerations for OTDRs
- Fiber identifiers
- Visual tracers
- Visual inspection
- Optical talk sets
- Optical dispersion testers
- Testing documentation

Optical Testing
- ANSI/TIA-568 testing terminology
- Test methods
- Multimode launch conditions
- Optical loss testing with a mandrel
- Mode suppressor loops
- Measurement-quality jumpers
- Referencing test methods
- Insertion loss methods
- “Not to exceed” attenuation reports
- Testing transmitter and receiver power
- OTDR dead zone
- Launch boxes and optical terminators
- OTDR signatures/traces
- Fiber roll-off
- Testing fiber optic splitters
- Index of refraction accuracy settings

Restoration
- Identify, locate, and resolve
- Effective maintenance planning
- Typical causes of failure
- Troubleshooting equipment
- Failure causes in coal mines
- Typical types of fiber damage
- Frequently encountered problems
- Restoration planning
- Emergency restoration kits
- Aerial restorations
- OSP restoration of ducted cable
- OSP restoration of direct buried cable
- Mine restorations
- Proactive versus reactive restorations
- Premises restorations
- The need for slack cable
- Post-restoration recommendations

Actives, Passives, and Loss Budgets
- Laser light sources
- Wavelength optimization
- Receivers – photo diodes
- Typical optical detector specifications
- Optical bidirectional devices
- Passive devices
- Optical splitters
- Multiplexers and multiplexing
- Attenuators
- System budgets

Safety Best Practices
- Visual safety using fiber optic sources
- Wavelength and the eye
- Laser classifications
- Safety eyewear
- Working with optical fibers
- Personal protective equipment
- Chemicals
- Safety data sheets (SDS)
- The work area
- Installation safety practices
- Aerial safety

Wrap-up and Review

Hands-on Skills Learning

Lab Safety

- Practice safety during the labs for yourself and your fellow participants.

Review of Safety Practices

Connectors

- Prepare a simplex jacketed fiber for termination.
- Prepare a simplex 900-micron fiber for termination.
- Clean a fiber connector endface.
- Test and inspect TFOCA connectors.
- Use inspection scopes to view a connector endface.
- Use a light source and power meter to measure loss on a mated connector pair.
- Prepare and install a mechanical splice-on connector.
- Use a visual fault locator to identify nearby bends and breaks.
- Assemble an ETA-compliant patch-cord.
- Practice proper tool usage for connector preparation.
- Recognize acceptable endface conditions.

Cable Preparation for Termination

- Practice proper tool usage for cable and buffer tube preparation.
- Identify fiber optic cable and jacket types.
- Prepare MSHA-rated distribution, breakout, and loose tube cables.
- Prepare a stranded cable for installation into a fiber closure/panel.
- Prepare buffer tube for a splice tray.
- Prepare a fanout kit.

Splicing and OTDRs

- Clean the test port and all connectors of an OTDR.
- Modify typical OTDR settings to obtain a clear interpretable trace.
- Recognize and interpret events depicted by an OTDR.
- Use an OTDR to test and identify events in a span.
- Use a launch box to enable identification of events close to the OTDR.
- Join fibers with a mechanical splice.
- Strip and cleave an optical fiber.
- Modify typical splicer settings to obtain a high-quality splice.
- Perform arc calibration on a fusion splicer.
- Create a fusion splice.
- Learn how to install a fusion splice-on connector.

Optical Loss Testing

- Inspect and identify connector contamination.
- Clean connector endfaces using wet and dry cleaning methods.
- Clean connectors using commercially available fiber optic cleaning products.
- Identify damaged connectors.
- Use a light source and power meter to observe the effects of a macrobend and microbend on a fiber.
- Learn one-, two- and three-cord reference testing.
- Create a loss budget for sample span of fiber.
- Measure optical loss for a span of fiber and compare to the calculated loss budget.
- Use a fiber identifier to detect active fibers