



Designation: F2349 – 04 (Reapproved 2010)

Standard Practice for Operation and Maintenance of Integrated Natural Gas Pipelines and Optical Fiber Systems¹

This standard is issued under the fixed designation F2349; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the operation and maintenance of natural gas distribution and service pipelines containing optical fiber cable and the operation and maintenance of the optical fiber system.

1.2 This practice applies to distribution and service lines used to transport natural gas.

1.3 This practice does not apply to natural gas transmission lines.

1.4 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 Referenced Documents:

ANSI Z 117.1-2003 Safety Requirements for Confined Spaces²

CFR 49 Code of Federal Regulations—Title 49, Part 192³

IEC 60825-1 Ed. 1.2 en 2001, Safety of Laser Products—Part 1: Equipment Classification, Requirements and User's Guide⁴

IEC 60050-731 Electrotechnical Vocabulary: Optical Fiber Communications⁴

¹ This practice is under the jurisdiction of ASTM Committee F36 on Technology and Underground Utilities and is the direct responsibility of Subcommittee F36.10 on Optical Fiber Systems within Existing Infrastructure.

Current edition approved May 1, 2010. Published July 2010. Originally approved in 2004. Last previous edition approved in 2004 as F2349 – 04. DOI: 10.1520/F2349-04R10.

² Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

³ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

⁴ Available from International Electrotechnical Commission (IEC), 3 rue de Varembé, Case postale 131, CH-1211, Geneva 20, Switzerland, <http://www.iec.ch>.

OSHA Regulation 29 CFR Part 1910.146, Permit-Required Confined Spaces⁵

3. Terminology

3.1 Definitions:

3.1.1 *CFR*—U.S. Code of Federal Regulations.

3.1.2 *class location*—the specific criteria for Class Locations 1, 2, 3, and 4 as defined in CFR 49, Part 192.5.

3.1.3 *conduit*—plastic tubing used to house optical fiber cable that is connected to, but not inside of, a pipeline.

3.1.4 *confined space*—an enclosed area that is large enough and so configured that a person can bodily enter and has the following characteristics: (1) its primary function is something other than human occupancy, and (2) has restricted entry and exit. (Restricted entry and exit is a physical configuration which requires the use of hands or contortion of the body to enter into or exit from a confined space.)

3.1.5 *covered tasks*—as defined in CFR 49, Part 192.801 (b): “an activity, identified by the operator, that is performed on a pipeline; is an operations and maintenance task; is performed as a requirement of this part and affects operation or integrity of the pipeline.”

3.1.6 *designated control point (DCP)*—specific documented locations in the pipeline system where the operations plan designates the control of gas.

3.1.7 *distribution lines*—a pipeline other than a gathering or transmission line.

3.1.8 *emergency incident*—an emergency incident may involve fire, damage to underground facilities, explosion, gas leak, injury, death, gas outage, district pressure problems, hazardous or toxic material spills, or response by fire, police, or other agencies.

3.1.9 *hot tapping*—a procedure for cutting or tapping into a gas pipeline under pressure.

3.1.10 *innerduct*—plastic tubing used to house optical fiber cable inside a natural gas pipeline.

⁵ Available from Occupational Safety and Health Administration (OSHA), 200 Constitution Ave., NW, Washington, DC 20210, <http://www.osha.gov>.

3.1.11 *operator*—a person who engages in the transportation of gas.

3.1.12 *operator qualification program*—the minimum requirements for operator qualification of individuals performing covered tasks on a pipeline. The general requirements are described in CFR 49, Part 192.801.

3.1.13 *optical fiber cable*—a cable formed of one or more strands of optical fiber for transmission of data, video, audio, voice, or other information.

3.1.14 *optical fiber cable owner*—the entity holding legal rights to, and responsible for the operation and maintenance of, the optical fiber cable. The owner is also responsible for operation and maintenance of any components associated with the optical fiber system that are not part of the pipeline as defined in this standard.

3.1.15 *optical fiber system*—a group of components that comprise the elements necessary to enable optical fiber cable to be installed, maintained, and operated inside a natural gas pipeline. The optical fiber system owner and pipeline operator are typically one and the same entity.

3.1.16 *pipeline*—all parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenance attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

3.1.17 *service line*—a distribution line that transports gas from a common source of supply to (1) a customer meter or the connection to a customer's piping, whichever is farther downstream, or (2) the connection to a customer's piping if there is no customer meter.

3.1.18 *transmission line*—a pipeline, other than a gathering line, that (1) transports gas from a gathering line or storage facility to a distribution center, storage facility, or (2) large volume customer that is not downstream from a distribution center, or operates at a hoop stress of 20 percent or more of specified minimum yield strength.

3.1.19 *vault*—a manhole, hand hole, or other enclosure used to store slack-loops of cable or fiber cable splice location, or both.

4. Summary of Practice

4.1 A gas pipeline containing optical fiber systems must be operated and maintained in a cost-effective manner with no significant negative impacts on gas customer service while maintaining or improving pipeline integrity and safety to employees, customers, and the public. In addition, the operation and maintenance of the optical fiber system and optical fiber cable must be accomplished with minimal impact on customers using the optical fibers for communication purposes and at an acceptable cost. In order to meet these criteria, the fittings, tools, and practices used to deploy and maintain an optical fiber system in gas pipelines must be well designed and employees responsible for implementation effectively trained to perform the required tasks. The areas specifically addressed in this standard practice are:

4.1.1 General safety considerations;

4.1.2 Emergency response procedures, including gas control, emergency pipe repair, and communication procedures;

4.1.3 Routine pipeline operation and maintenance activities, including service and main connections, pipe repair, leak detection, and leak inspection;

4.1.4 Routine optical fiber system operations and maintenance activities;

4.1.5 Cable and conduit marking; and

4.1.6 Operator qualification.

5. Significance and Use

5.1 This practice is intended to assist optical fiber cable owners and pipeline operators in developing operating and maintenance procedures and practices for the secondary use of gas pipelines as conduits for optical fiber cables. It must be kept in mind that the primary use of gas pipelines is for transportation of natural gas and any secondary use of the system must not materially impact the primary function. It is the responsibility of the optical fiber cable owner and pipeline operator to decide how best to integrate operating and maintenance procedures for the pipeline, the optical fiber system, and the optical fiber cable so that safety is not compromised, customers are served in the best way possible, and incremental costs are minimized.

5.2 Since the practice of integrating gas pipeline facilities and fiber optics for telecommunications purposes is a new and emerging activity, this standard will help establish guidelines for its rapid and safe deployment and will ensure that the facilities installed are maintained to operate on a long-term basis.

6. Operations and Maintenance

6.1 *General Safety Considerations:*

6.1.1 Employ proper grounding procedures when working on or near gas pipelines.

6.1.2 Take necessary steps to prevent buildup of static electricity during fiber cable system operations near gas pipelines. This includes operations involving pulling innerduct or optical fiber cable into the gas pipeline.

6.1.3 When working with optical fiber cables, care must be taken to avoid fiber penetration through the skin or laser-induced eye damage. For specific guidelines, refer to IEC 60825-1, Ed. 1.2, en 2001.

6.1.4 Always check for the presence of gas prior to and during work on optical fiber systems or optical fiber cable that are connected to, contiguous with, or in the vicinity of gas pipelines.

6.2 *Mapping and Record-Keeping:*

6.2.1 Each pipeline operator must keep adequate records of the type and location of all parts of the optical fiber system that are part of the pipeline. The operator should consider recording high consequence areas (in accordance with CFR 49) where optical fiber systems are located.

6.2.2 Records may be in the form of maps, drawings, notes, or any combination thereof.

6.2.3 The records must be available to the local operating personnel responsible for the pipeline where the optical fiber system is deployed.

6.2.4 Records should be employed by the pipeline operator to minimize the possibility that the optical fiber system is inadvertently damaged by pipeline operator activities.

6.3 *Emergency Response Procedures Involving Pipeline Facilities and Optical Fiber Systems:*

6.3.1 *Standard Requirements*—The pipeline operator must adhere to emergency procedures as required by CFR 49, Subpart F, Part 192.615. These procedures must be modified to account for any special conditions or tools needed to deal with emergency responses to pipelines containing optical fiber cable.

6.3.2 *On-Site Management Control*—For emergency incidents where there is a possibility of an unsafe condition involving natural gas or natural gas facilities, the pipeline operator employee on site must control all activities related to the incident and is required to follow their written emergency procedures. This means that any optical fiber cable owner representative present at the emergency site must consult with and defer to the pipeline operator regarding any proposed activity at or near the site. The pipeline operator will take steps to stabilize the emergency incident to eliminate any related safety issues as quickly as possible so that the optical fiber cable owner may take necessary steps to deal with any fiber cable issues, including installation of a temporary cable bypass connection in or near the emergency incident location.

6.3.3 *Incorporating Optical Fiber System Design into Emergency Response Procedures:*

6.3.3.1 *Use of Designated Control Points (DCP)*—An optical fiber system should be designed such that fiber cable exit and re-entry points afford an adequate space on the pipe to install one or more gas stopping fittings or to pinch close the pipe. At such locations, between exit and re-entry points in the pipe, fiber cable is not present and any conventional method of gas control is acceptable.

NOTE 1—Polyethylene pipe used in natural gas pipelines is generally designed to allow pinching only once at a given location.

6.3.3.2 *Design Distance Between DCPs*—The recommended maximum distance between pairs of exit and re-entry fittings should be chosen to minimize the requirements to control gas within the span length during emergency incidents. The pipeline operator should attempt to control gas at these designated fitting exit and re-entry locations during an emergency incident to avoid optical fiber cable damage. In many cases, effective control of a pipeline can be achieved without cable damage if the exit and re-entry fitting pairs are located no more than 1500 feet apart. In some cases, the pipeline operator may choose to reduce this maximum spacing depending on local conditions, and class location present.

6.3.3.3 *Controlling Gas Without DCPs*—If desired, a pipeline operator may also base emergency control procedures on controlling gas at locations in the pipe where optical fiber cable is present. However, damage of the optical fiber cable may occur and gas flow may not be stopped unless specially designed stopping fittings and pinching machines are used.

These special tools may be available from optical fiber system vendors or vendors of conventional pipeline gas stopping tools.

6.3.3.4 If the operator controls gas at a location where innerduct is present by use of a pinching or stopping device, procedure should require checking the innerduct to ensure it is not damaged so that it becomes pressurized with gas (see 6.3.6). If it does, control gas in the innerduct using procedures developed or approved by the operator.

6.3.4 *Notification and Communication between Pipeline Operator and Optical Fiber Cable Owner:*

6.3.4.1 *Notification Contacts*—The pipeline operator and optical fiber cable owner or designee will notify each respective party of emergency incidents related to natural gas, pipeline facilities, or the optical fiber system. Usually, the pipeline operator will become aware of a gas facility-related emergency incident first and should notify the optical fiber cable owner representative in a manner covered in a written agreement between the parties. Likewise, if the optical fiber cable owner detects an optical fiber cable or innerduct break located in a gas pipeline through its monitoring equipment, it shall immediately notify the pipeline operator.

6.3.4.2 *Conditions for Notification*—If possible, the pipeline operator will contact the optical fiber cable owner prior to action being taken if:

- (1) The pipeline operator must take action on the gas pipeline that may damage the optical fiber system,
- (2) The damaged gas line contains optical fiber cable, and
- (3) There is a possibility that assistance by the optical fiber cable owner may be required, but no immediate action is necessary.

6.3.4.3 *Documentation of Communication Protocol*—A written guideline should be developed and kept on file with both the pipeline operator and the optical fiber cable owner containing the following information:

- (1) Pipeline operator contact information for emergency response,
- (2) Optical fiber cable owner contact information for emergency response,
- (3) Criteria for an event to trigger emergency response notification, and
- (4) Agreement on hierarchy of notification and target time for notification after incident occurs.

6.3.5 *Damage to Gas Pipeline and Optical Fiber System:*

6.3.5.1 *Response*—Control of gas being released to the atmosphere, whether coming from the pipeline or the optical fiber system, is performed by the pipeline operator.

6.3.5.2 *Controlling an Unsafe Situation*—The pipeline operator must act in a manner consistent with its emergency response plan to control an unsafe situation. In most cases, controlling leaking or blowing gas can be achieved safely by use of stopping fittings, valves, or pipe pinching at DCPs as described in 6.3.3.1. If not, the pipeline operator must control the gas at an intermediate point where optical fiber cable or conduit, or both, are located as described in 6.3.3.3.

6.3.5.3 *Check Optical Fiber Cable System at Adjacent Vault Locations*—If the optical fiber cable system uses conduit to house the optical fiber cable outside the pipeline and the conduit terminates in a vault, the vaults adjacent to the