Designation: F2350 – 04 (Reapproved 2010)

Standard Practice for Selection of Natural Gas Pipelines Suitable for Installation of Optical Fiber Systems[1]

This standard is issued under the fixed designation F2350; 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 specifically addresses the criteria for determining the suitability of natural gas pipelines for use as conduits for optical fiber cable systems, as opposed to standards for the operation and maintenance of such a system.

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

1.3 *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 *ASTM Standards:*[2]

D1600 Terminology for Abbreviated Terms Relating to Plastics

F412 Terminology Relating to Plastic Piping Systems

2.2 *Code of Federal Regulations (CFR) References:*[3]

CFR 49, Part 192 Transportation of Natural or Other Gas by Pipeline, Minimum Federal Safety Standards

3. Terminology

3.1 Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

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

3.2.2 *gas*—natural gas.

3.2.3 *high-pressure distribution system*—a distribution system in which the gas pressure in the main is higher than the pressure normally provided to the customer (that is, higher than utilization pressure).

3.2.4 *installer*—the person(s) or body installing the optical fiber system within the natural gas pipeline.

3.2.5 *local distribution company (LDC)*—the owner/operator of the natural gas piping system within a specific geographic area.

3.2.6 *low-pressure distribution system*—a distribution system in which the gas pressure in the main is substantially the same as the pressure provided to the customer.

3.2.7 *main*—a distribution line that serves as a common source of supply for more than one service line.

3.2.8 *maximum actual operating pressure*—the maximum pressure that occurs during normal operations over a period of one year.

3.2.9 *maximum allowable operating pressure (MAOP)*—the maximum pressure at which a pipeline or segment of a pipeline may be operated under CFR 49, Part 192.

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

3.2.11 *optical fiber system*—a group of components that comprises the elements necessary to enable Optical Fiber Cable to be installed, maintained, and operated inside a gas pipeline.

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

3.2.13 *pipe (piping)*—any pipe or tubing used in the transportation of gas.

3.2.14 *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.

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[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 June 2010. Originally approved in 2004. Last previous edition approved in 2004 as F2350 – 04. DOI: 10.1520/F2350-04R10.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[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.

3.2.15 *service line*—a distribution line that transports gas from a common source of supply to a customer meter or the connection to a customer's piping, whichever is farther downstream.

3.2.16 *transmission line*—a pipeline, other than a gathering line, that: *(a)* Transports gas from a gathering line or storage facility to a distribution center, storage facility, or large volume customer that is not downstream from a distribution center; or *(b)* Operates at a hoop stress of 20 % or more of SMYS.

4. Summary of Practice

4.1 The optical fiber systems in existing gas pipelines shall be designed and installed so that they have a minimal effect on pipeline performance, and current and future gas delivery capability, and no effect on their structural integrity. Their design and installation shall also allow for the safe and efficient operation and maintenance of the pipeline, and provide for the safe and efficient operation of the optical fiber system. The first step in the evaluation process is an analysis of the capacity of the gas piping to confirm available capacity for the installation of an optical fiber system. The ultimate success of the installation and operation of both the optical fiber and gas pipeline systems depends upon the proper evaluation and selection of appropriate pipelines. The steps in the selection process include evaluation of the following items:

4.1.1 Pipeline integrity and useful life,

4.1.2 Standards for installed components,

4.1.3 Standards for gas quality,

4.1.4 Standards for the safe use of optical fibers in flammable atmospheres,

4.1.5 Determine franchise and right of way impacts,

4.1.6 Installation of the optical fiber system,

4.1.6.1 Confirming the pipeline network's capacity,

4.1.6.2 Selection of pipeline,

4.1.6.3 Determine custody/ownership transfer point,

4.1.6.4 Installation of the optical fiber system, and

4.1.7 Documentation of cable routing.

5. Significance and Use

5.1 This practice is intended to assist engineers, LDC's and installers in determining the suitability of gas pipelines for a secondary use as carriers for optical fiber systems. It must be kept in mind that the primary use of the gas pipelines is to deliver natural gas to the end customer. Any secondary use of the system shall have minimal impact on its primary function. It is up to the engineer to decide upon the order of operations and any exceptions that may be involved in the selection process.

5.2 Before the selection procedure begins, the LDC must have developed an explicit agreement authorizing an installer to place optical fiber cables within their piping system.

5.3 The relevant LDC engineers should also be cognizant of how the installation of optical fiber cable will impact the future gas deliverability, operation, maintenance, and rehabilitation needs of the pipelines to be used as carriers of optical fiber systems.

6. Selection of Pipeline

6.1 The following is a list of issues and criteria to consider when selecting a gas pipeline for use as a carrier of optical fiber conduit or cable, or both:

6.1.1 *Gas Quality*—Free or disassociated hydrogen at high concentrations in the gas stream may affect optical fiber systems by diffusion through polyethylene components. The operator or optical fiber owner should confirm gas quality in relation to the optical fiber system being used, to ensure that there will be no interference from hydrogen.

6.1.2 *Franchise Impacts*—The LDC operator should confirm the terms of their franchise agreement to determine if the insertion of optical fiber systems is permitted under that agreement. Similarly, easements that are part of a planned route should be examined to confirm that they allow the gas operator to install an optical fiber system.

6.1.3 *Pipeline Capacity*—The operator should conduct a network analysis to confirm that any loss of capacity from use of an optical fiber system does not hinder current or near-future peak day deliverability to customers, and that any bypassing or system pressure reduction required during installation will not affect that particular season's gas deliverability.

6.1.4 *Maximum Operating Pressure of the System and Ratings of the Optical Fiber System*—This confirms that the system components or their installation methods do not exceed their pressure ratings.

6.1.5 *Number and Position of Valves*—The ability to install straight runs may be important for project economics. Knowing where valves are installed will allow planning to circumvent the valves, or to reposition them to maximize installation effectiveness.

6.1.6 *Number and Position of Elbows and Other Fittings*—The optical fiber system installation may have difficulty navigating certain elbows or fittings (especially if there are drips, and so forth). It will be important to identify those fittings for construction planning purposes.

6.1.7 *Method of Attaching Installation Fittings*—Some optical fiber systems may be optimized for a certain gas piping material. The need for transition, or different fittings will need to be identified, and relevant planning undertaken.

6.1.8 *Determine Custody/Ownership Transfer Point Issues*—Any agreements with installers/owners of an optical fiber system should clearly define the ownership transfer point; that is, the point at which the facility no longer belongs to the LDC, but to the operator of the optical fiber system. Typically this will also be the demarcation of responsibility for operation and maintenance of the optical fiber system.

6.1.9 *Impact on Pipeline Integrity*—As with any operation on or attachment to a gas pipeline system, the impact on short-and long-term pipeline integrity must be considered. Careful attention should be paid to plastic pipeline made from material that is susceptible to brittle cracking, unprotected steel and older cast-iron pipes.

6.1.10 *Pipeline Integrity Monitoring Requirements*—Gas pipelines may be required to be assessed for structural integrity on a periodic basis. The optical fiber system installation shall not preclude these types of inspections.

7. Keywords

7.1 conduits; criteria; installation; natural gas; pipeline; selection