



Designation: F3092 – 14 (Reapproved 2024)

Standard Terminology Relating to Optical Fiber Sensing Systems¹

This standard is issued under the fixed designation F3092; 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 terminology standard is a compilation of definitions of technical terms related to optical fiber sensing systems, used in the various sections of standards under the jurisdiction of ASTM Committee F36.

1.2 Where possible, definitions are stated as a single sentence, with necessary supplementary information as a Discussion. This approach is used to simplify explanations of the meanings of technical terms for the benefit of those not conversant with them, to facilitate a precise understanding and interpretation of F36 ASTM standards.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

F2233 Guide for Safety, Access Rights, Construction, Liability, and Risk Management for Optical Fiber Networks in Existing Sewers

F2303 Practice for Selection of Gravity Sewers Suitable for Installation of Optical Fiber Cable and Conduits

F2304 Practice for Sealing of Sewers Using Chemical Grouting

F2349 Practice for Operation and Maintenance of Integrated Natural Gas Pipelines and Optical Fiber Systems (Withdrawn 2017)³

F2350 Practice for Selection of Natural Gas Pipelines Suitable for Installation of Optical Fiber Systems (Withdrawn 2017)³

F2414 Practice for Sealing Sewer Manholes Using Chemical Grouting

F2454 Practice for Sealing Lateral Connections and lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting

F2462 Practice for Operation and Maintenance of Sewers with Optical Fiber Systems

F2550 Practice for Locating Leaks in Sewer Pipes By Measuring the Variation of Electric Current Flow Through the Pipe Wall (Withdrawn 2022)³

F2551 Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes

3. Significance and Use

3.1 Definitions in this standard are to be regarded as correct for the terms found in other ASTM standards of Committee F36. Certain terms may be found in more than one standard issued under the jurisdiction of this committee and many of these terms have been placed in this standard.

4. Terminology

4.1 Terms and Definitions:

absorption, n —the loss of some or all of the energy contained in an electromagnetic wave to the medium in which it is propagating, usually converted to heat.

acceptance angle, n —the maximum angle, measured from the optical fiber centerline to an incident light ray, within which the incident ray will be accepted for transmission by total internal reflection along the fiber.

DISCUSSION—If the incident angle is greater than the acceptance angle, total internal reflection will not occur and the incident ray will be lost by leakage.

access rights, n —agreements between various parties to obtain temporary and permanent access to property for the purpose

¹ This terminology is under the jurisdiction of ASTM Committee F36 on Technology and Underground Utilities and is the direct responsibility of Subcommittee F36.91 on Terminology.

Current edition approved Feb. 1, 2024. Published February 2024. Originally approved in 2014. Last previous edition approved in 2019 as F3092 – 14 (2019). DOI: 10.1520/F3092-14R24.

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 The last approved version of this historical standard is referenced on www.astm.org.

of constructing, maintaining, or changing optical fiber networks. **F2233**

accuracy, *n*—the closeness of the measured value to the true or the ideal value of the parameter being measured and is affected by both bias and precision.

acoustic wave, *n*—longitudinal waves propagated by means of adiabatic compression and decompression.

acousto-optics, *n*—the science and technology of the interactions between sound waves and light waves passing through material media, especially as applied to the modulation and deflection of laser beams by ultrasonic waves.

acrylamide, *n*—organic solid of white, odorless, acrylic resinous material available in flake-like crystals and in liquid form. The greatest use of acrylamide is as a coagulant aid in drinking water treatment. Other major uses of acrylamide are in soil stabilization, in grout for repairing sewers, and in acrylamide gels used in biotechnology laboratories. **F2414**

acrylate, *n*—a general term applied to various water-soluble acrylic resinous materials. **F2414**

adit, *n*—*in tunneling*, a tunnel driven from ground surface to provide access to or drainage from underground workings; a length of tunnel driven for an exploration-exploration adit.

advance, *n*—*in tunneling*, the forward progress in the construction of a tunnel, usually measured by the length created, or the rate of segment positioning in terms of a number per hour/day or some other timescale.

ambient temperature, *n*—the temperature of the surrounding environment or air. **F2304**

Angstrom, A, *n*—a unit of length equal to 10^{-1} nanometer (10^{-1} nm), 10^{-4} micron (10^{-6} mm), and 10^{-10} meter (10^{-10} m).

annulus, *n*—*in tunneling*, a ring-shaped opening, generally bounded by the outside diameter of excavated tunnel and the exterior of the final tunnel liner. **F2304**

aperture, *n*—*in optics*, a hole or an opening through which light travels.

attenuation, *n*—the decrease in optical power of a signal, or light wave, from interaction with the propagation medium, for example, absorption, reflection, diffusion, scattering, deflection, dispersion or resistance.

attenuation budget, *n*—the maximum cumulative one-way or two-way optical power loss between the interrogator and the measurement point that allows a measurement with a specified performance.

attenuation range, *n*—total cumulated optical loss (one way loss; expressed in decibels (dB)) tolerated by the DRS system without affecting the specified measurement performance more than a given factor at a given location, spatial resolution, and measurement time.

DISCUSSION—Part of the total cumulative loss can be the fiber attenuation, point defect losses introduced by components such as connectors, splices, kink in the fiber, attenuators, etc.

authorized inspector, *n*—the person(s) contracted or approved by the owner or owner's representative to do inspections. **F2414**

backfill, *n*—*in tunneling*, a material used to replace excavated soil.

bandwidth, *n*—the range of frequencies that a device is capable of handling.

beam splitter, *n*—an optical device for dividing a light beam into two separated beams.

bench, *n*—*in tunneling*, in situ ground at the lower face of a tunnel undergoing staged excavation.

bend loss, *n*—optical power loss in an optical fiber because signal radiation escapes through its bends, with the magnitude of optical power loss being proportional to the bending radius.

bending radius, *n*—the radius of a bend measured in a fiber optic cable.

bentonite, *n*—clay composed mainly of clay mineral 'montmorillonite,' used for synthetic reasons, due to its expanding properties when in contact with water, for example, drilling mud, binder, absorbent, groundwater barrier, etc.

bias, *n*—the difference between the measured results after averaging, less the true value.

birefringence, *n*—the separation of a light beam into two components to form two rays propagating at different velocities in the medium.

bolt pocket, *n*—*in tunneling*, a pre-formed recess in tunnel segment to accommodate bolts which hold segments together.

bore, *n*—*in tunneling*, the internal diameter of a pipe or other cylinder, single tunnel, for example, twin bore.

borehole, *n*—a hole driven into the ground to get information about the strata, or to release water pressure by vertical sand drains, or to obtain water, oil, gas, etc.

boring/bored, *n*—making a hole in the ground by means of rotating auger.

box jack/jacked box, *n*—*in tunneling*, a fully constructed structure that is thrust into final position from an adjacent jacking point.

Bragg cell, *n*—an acousto-optic device that is capable of modulating light waves to produce an output light wave with an imposed frequency equal to the frequency of the input signal.

Brillouin optical time domain analysis, BOTDA, *n*—double ended access to the light source and detection system for long sensing lengths combined with high strain and temperature resolution for up to 31 miles (50 km) without signal regeneration.