



IEEE Standard for Broadband over Power Line Hardware

IEEE Power & Energy Society

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Power System Communications Committee

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**Power System Communications Committee
of the
IEEE Power & Energy Society**

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Abstract: Testing and verification standards for the commonly used hardware, primarily couplers, and enclosures, for broadband over power line (BPL) installations, and installation methods to enable compliance with applicable codes and standards are provided in this standard.

Keywords: broadband over power line communications, broadband power line, coupler, installation, medium voltage

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Introduction

This introduction is not part of IEEE Std 1675-2008, IEEE Standard for Broadband over Power Line Hardware.

Broadband over power line (BPL) equipment and methods comprise communications equipment, signal couplers, and installation methods, related to carrying high-speed data over low- and medium-voltage power lines. Standards for communications equipment powered from low-voltage power lines already exist and include Telcordia GR-487-CORE, Generic Requirements for Electronic Equipment Cabinets [B9], and IEC 60950, International Safety Standard for Information Technology Equipment.^{a, b} This standard covers signal couplers and installation methods.

This standard is a part of a planned IEEE series of BPL standards that cover major aspects of BPL communication technology: safety, electromagnetic compatibility, media, coexistence, interoperability, and education.

A power line coupler acts as an insulating interface between power lines and communications equipment. Power lines may carry high levels of energy, whether at their nominal operating voltage or through the surges that appear on these lines during lightning strikes, switching transients, or faults. A properly designed and tested coupler minimizes risks associated with coupler installation and usage.

Accepted safety criteria and test methods facilitate the use and deployment of BPL. The resulting safety standard will increase the level of confidence between interested parties. It will also be instrumental in guiding the design, installation, and maintenance of BPL equipment and installations.

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^a The numbers in brackets correspond to those of the bibliography in Annex A.

^b Information on references can be found in Clause 2.

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1. Overview

1.1 Scope

The scope of this standard is to provide testing and verification standards for the commonly used hardware, primarily couplers, and enclosures, for broadband over power line (BPL) installations, and provide standard installation methods to enable compliance with applicable codes and standards. This standard does not cover repeater/node hardware, data transmission, protocols, or other aspects of BPL related to the internal workings of this technology.

1.2 Purpose

The BPL industry in the United States is in its infancy. For this technology to become widespread, standards must be put in place that will enable utilities to quickly develop a BPL program without the tedious task of investigating every possible hardware solution for safety and usability. A BPL standard will give both the utilities and the BPL industry the ability to confidently pursue a BPL installation. In addition, because of the nature of BPL, non-utility personnel will be working in close proximity to areas that are commonly considered off-limits to all personnel except for qualified linemen. The purpose of this standard is to provide the boundaries of what is strictly the working area for linemen only in the utility environment, and detail construction practices that enable adherence to applicable codes and standards.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Accredited Standards Committee C2-2007, National Electrical Safety Code® (NESC®).¹

ANSI C29.1-1988 (Reaff 2002), American National Standard for Electrical Power Insulators—Test Methods.²

ANSI C29.11-1989 (Reaff 1996), American National Standard for Composite Suspension Insulators for Overhead Transmission Lines—Tests.

ANSI C29.13-2000, American National Standard for Insulators—Composite Distribution Deadend Type.

ANSI C37.42-1996, American National Standard Specification for High-Voltage Expulsion Type Distribution Class Fuses, Cutouts, Fuse Disconnecting Switches and Fuse Links.

ANSI S1.4-1983 (Reaff 2006), American National Standard Specification for Sound Level Meters.

IEC 60044-5, Instrument transformers—Part 5: Capacitor voltage transformers.³

IEC 60099-4, Surge arresters—Part 4: Metal-oxide surge arresters without gaps for a.c. systems.

IEC 60721-1, Classification of environmental conditions—Part 1: Environmental parameters and their severities.

IEC 60815, Guide for the selection of insulators in respect of polluted conditions.

IEC 60950, International Safety Standard for Information Technology Equipment.

IEC 61334-3-22: 2001, Distribution automation using distribution line carrier systems—Part 3-22: Mains signalling requirements—MV phase-to-earth and screen-to-earth intrusive coupling devices.

IEEE Std 4™-1995, IEEE Standard Techniques for High-Voltage Testing.^{4, 5}

IEEE Std 487™, IEEE Recommended Practice for the Protection of Wire-Line Communications Facilities Serving Electric Supply Locations.

IEEE Std 1590™-2003, IEEE Recommended Practice for the Electrical Protection of Optical Fiber Communication Facilities Serving, or Connected to, Electrical Supply Locations.

IEEE Std C57.13™-1993, IEEE Standard Requirements for Instrument Transformers.

IEEE Std C57.124™-1991, IEEE Recommended Practice for the Detection of Partial Discharge and the Measurement of Apparent Charge in Dry-Type Transformers.

IEEE Std C62.11™, IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV).

¹ The NESC is available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org/>).

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3. Definitions, acronyms, and abbreviations

For the purposes of this standard, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms* [B4] should be referenced for terms not defined in this clause.⁶

3.1 Definitions

3.1.1 arcing distance: The direct through-air distance between a primary conductor and the nearest grounded body.

3.1.2 BPL communications device: A device that connects to a BPL signal coupler, such as a modem or communications node.

3.1.3 capacitive arrester-coupler: A capacitive BPL signal coupler including a surge arrester element in parallel with the capacitive coupling element.

3.1.4 capacitive coupler: A device intended to couple BPL signals bi-directionally onto a power line, and including a capacitive element withstanding the line voltage.

3.1.5 coupler communications port: The terminals on the BPL signal coupler that connect to the BPL communications device.

3.1.6 design family: A set of unique designs that share common high-voltage performance characteristics. Differences between design variations in the design family do not affect high-voltage performance.

3.1.7 ground fault factor: The factor by which a phase-to-neutral voltage may rise, if another phase is faulted to ground.

3.1.8 highest voltage for equipment: The highest rated rms phase-to-phase voltage of power lines for which a coupler is designed. Coupler insulation may be designed for phase-to-neutral or phase-to-phase connection.

3.1.9 hybrid coupler: A device intended to couple BPL signals bi-directionally onto a power line, and including an inductive element in series with the power line and a capacitive element withstanding the line voltage.

3.1.10 inductive coupler: A device intended to couple BPL signals bi-directionally onto a power line, and including an inductive element in series with the power line.

3.1.11 medium voltage (MV): Medium-voltage lines may be overhead or underground, depending on the power grid network topology.

NOTE—This standard applies to medium-voltage levels up to 38 000 V.⁷

3.1.12 overhead coupler: A BPL signal coupler in contact with a primary voltage, for use on overhead or underground lines.

3.1.13 primary aperture of the inductive or hybrid coupler: An aperture through which the primary wire is intended to be passed.

⁶ The numbers in brackets correspond to those of the bibliography in Annex A.

⁷ Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.