

# IEEE Guide for the Application of Surge-Protective Devices for Use on the Load Side of Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits

IEEE Power and Energy Society

Sponsored by the  
Surge Protective Devices Committee

# **IEEE Guide for the Application of Surge-Protective Devices for Use on the Load Side of Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits**

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**Surge Protective Devices Committee  
of the  
IEEE Power and Energy Society**

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**Abstract:** Guidance is provided to specifiers, users and manufacturers of surge-protective devices (SPDs) about the application considerations of SPDs to power distribution systems and associated equipment. This guide applies to SPDs to be connected to the load side of the service equipment (and main over current protective device) of 50 Hz or 60 Hz ac power circuits rated 1000 V ac or less. Information on surge origins, effects of surges, number and magnitude of surge events, location categories, power distribution system (PDS) configurations, grounding and bonding, SPD specifications, SPD ratings, SPD characteristics, SPD lifetime, interactions of SPDs with a PDS, and SPD coordination considerations are provided in the guide.

**Keywords:** arrester, bonding, grounding, IEEE C62.72™, internally generated surges, lightning, SPD, surge-protective device coordination, surge-protective device, switching, transient, transient voltage surge suppressor

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## Introduction

This introduction is not part of IEEE Std C62.72-2016, IEEE Guide for the Application of Surge-Protective Devices for Use on the Load Side of the Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits.

One purpose of this guide is to provide specifiers, users, and manufacturers of surge-protective devices (SPDs) with an understanding of numerous application considerations to be evaluated before SPDs are installed in low-voltage ac power circuits. Given this understanding, specifiers, users and manufacturers can exercise due diligence in applying SPDs, take steps to prevent their misapplications, and act to either prevent or mitigate adverse effects that SPDs may have on a power distribution system (PDS) in an effort to improve the effectiveness and benefit of applying SPDs to the PDS.

The growth of interest in and use of low-voltage power SPDs parallels the increasing number of installations with sensitive, sophisticated, and expensive electronic equipment and components that can be exposed and susceptible to surge voltages. It must be recognized that SPDs are not designed to correct every type of power system disturbance. However, SPDs can be extremely effective at mitigating the impact of transient overvoltages or surges. The functionality of any SPD is directly related to the specific location where it is connected to a low-voltage PDS and the methods used to make the required electrical connections to the PDS. SPDs installed at various locations in the low-voltage PDS, as well as in specific equipment, can interact with each other, with protective relaying systems, and with other components of the PDS. Due to the complex nature of surges and the numerous environments where surges are generated and SPDs exist, the application of SPDs has yet to become an exact science.

This guide is one document in the IEEE C62™ group of standards that deals with power systems surges and surge protection. Other IEEE C62 documents describe performance characteristics of SPDs, recommend standard test protocols for verifying performance, and provide guidance on the interaction between power systems disturbances and SPDs. This application guide is the sister document to IEEE Std C62.62™<sup>1</sup>, IEEE Standard Test Specifications for Surge Protective Devices (SPDs) for Use on the Load Side of the Service Equipment in Low-Voltage (1000 V and Less) AC Power Circuits. The guide was limited in scope to the load side of the service equipment to harmonize with IEEE Std C62.62 and to prevent conflict with another project, PC62.44™, which covers the application of SPDs on the line side of the service equipment.

As part of the ongoing improvement and life cycle of this guide, the following topics and changes were specific work areas focused on by the working group:

- Discussion of internally generated surges due to normal and abnormal system operations
- Expanded explanation of short-circuit current ratings of SPDs including fault current and load-side short circuit interruption capability
- The grounding (earthing) and bonding clause of the guide underwent a major revision while emphasizing the discussion around SPD applications
- Discussion of the surge tests described in IEEE Std C62.62 and how they impact the application of SPDs
- Revisions to the clauses regarding SPD surge current, nominal discharge current ratings and the use of these ratings for specifying SPDs
- Additional guidance on the maximum continuous operating voltage rating

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<sup>1</sup> Information on references can be found in Clause 2.

- A clause further dispelling the use of response time as a useful characteristic on an SPD
- A direct statement that energy ratings (Joule ratings) should not be used when characterizing SPDs
- Guidance on the load-side surge withstand capability of two-port SPDs
- An explanation of the UL SPD Types nomenclature from (UL 1449 [B72]<sup>2</sup>)
- Explanation of SPD enclosure ratings and application considerations
- Application considerations regarding SPD disconnectors
- SPD safety and regulatory considerations
- Expanded discussion of SPD modes of protection
- Discussion of overvoltage failures of SPDs and TOVs
- Extensive additions to the clauses on SPD coordination considerations
- Surge waveforms and durations, ring waves, combination wave generator surges
- SPD conductor connection length
- Distance between SPDs
- Comparison and coordination of SPD terminology
- SPD maximum continuous operating voltage coordination
- Surge current rating/nominal discharge current rating coordination
- Aging of SPDs
- Coordination of SPDs to the grounding (earthing) and bonding system
- Integral installation of SPDs within electrical distribution and end-use equipment
- SPDs used in conjunction with lightning protection systems
- SPD installation in hazardous locations
- SPD documentation

Suggestions for improvements to this guide are welcome. They should be sent to the Secretary, IEEE Standards Board, The Institute of Electrical and Electronic Engineers, 445 Hoes Lane, Piscataway, NJ 08854-4131, USA.

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<sup>2</sup> The numbers in brackets correspond to those of the bibliography in Annex A.

## Contents

1. Overview .....	13
1.1 Scope .....	13
1.2 Purpose .....	13
2. Normative references.....	14
3. Definitions, acronyms, and abbreviations .....	14
3.1 Definitions .....	14
3.2 Acronyms and abbreviations .....	16
4. Introduction to surge protection .....	17
5. Surge origins.....	18
5.1 Lightning .....	18
5.2 Switching.....	19
6. Effects of surges .....	23
6.1 No observed change.....	23
6.2 Upset.....	23
6.3 Damage.....	24
6.4 Consequential damage .....	24
7. Number and magnitude of surge events .....	24
7.1 General .....	24
7.2 Environmental factors.....	24
7.3 Changes in the power distribution system (PDS) .....	25
7.4 Rate of occurrence (versus) current level .....	25
7.5 Exposure levels.....	27
7.6 Risk assessments.....	28
8. Location categories.....	30
9. Power distribution systems .....	31
9.1 System configuration .....	34
9.2 System arrangement or distribution .....	35
9.3 Examples of system voltages.....	35
9.4 Available short-circuit current and SPD short-circuit current rating .....	35
9.5 Voltage ratings of SPDs.....	40
10. Grounded (earthed) and ungrounded (unearthed) systems .....	41
10.1 Grounded (earthed) systems .....	41
10.2 Impedance (resistance) grounded systems.....	42
10.3 Ungrounded (unearthed) systems .....	42
10.4 Ferroresonance.....	42
11. Grounding (earthing) and bonding .....	44
11.1 SPD grounding lead and related considerations .....	45
11.2 Common bonding network .....	46
11.3 Grounding.....	48
11.4 Ground (earth) potential rise (GPR/EPR).....	48

12. Modes of operation.....	49
12.1 Considerations for neutral-to-ground SPD application.....	50
13. SPD specifications, ratings and characteristics.....	51
13.1 Measured limiting voltage.....	51
13.2 SPD Surge current and Nominal Discharge Current ratings.....	55
13.3 SPD maximum continuous operating voltage (MCOV) rating.....	57
13.4 SPD response time.....	58
13.5 Joule (energy) ratings.....	59
13.6 Rated load current, IL.....	59
13.7 Fault current interruption capability.....	59
13.8 Temperature ratings.....	60
13.9 Load-side surge withstand.....	60
13.10 Voltage regulation (voltage drop) of an SPD.....	60
13.11 SPD power system configuration.....	61
13.12 SPD types.....	61
13.13 SPD Enclosure Rating.....	61
13.14 SPD status indicators.....	63
13.15 SPD disconnectors.....	64
13.16 SPD certification and safety considerations.....	64
13.17 SPD modes of protection.....	65
14. SPD lifetime.....	66
14.1 Overvoltage failures of SPDs.....	67
14.2 Temporary overvoltages (TOVs).....	68
15. Interactions of SPD operations in a power distribution system (PDS).....	68
15.1 Interactions with ground-fault protection (GFP) systems.....	69
15.2 Interaction of SPD operation on other protective relaying systems.....	69
15.3 Interaction of SPD operation on other protective devices.....	70
16. SPD coordination considerations.....	70
16.1 Surge waveform and duration.....	71
16.2 SPD conductor (lead) length.....	73
16.3 Distance between SPDs, types, location categories and IEC test classes.....	77
16.4 Distance between the origin of a surge and the end-use equipment.....	80
16.5 Surge-protective device voltage coordination.....	81
16.6 Surge current capacity and Nominal Discharge Current ( $I_n$ ) Ratings of the SPDs.....	82
16.7 Aging of SPDs.....	82
16.8 Coordination of modes of protection.....	83
16.9 Power distribution system configuration.....	83
16.10 SPDs integral to electrical distribution and end-use equipment.....	84
16.11 Coordination of the SPD's Short-Circuit Current Rating (SCCR).....	85
16.12 SPDs used in a lightning-protection system (LPS).....	85
16.13 Installation in hazardous locations.....	86
16.14 Coordination methodologies.....	86
16.15 SPD documentation.....	87
17. Summary.....	88

Annex A (informative) Bibliography .....	89
Annex B (informative) Glossary .....	93
Annex C (informative) IEC earthing (grounding) practices .....	94
C.1 First letter (I or T) .....	94
C.2 Second letter (T or N) .....	96
C.3 Third letter (C or S).....	99
C.4 TN-C-S Systems .....	99
C.5 Differences highlighted.....	100
Annex D (informative) Methods of transient mitigation .....	101
D.1 “Attenuating” devices .....	101
D.2 “Diverting” devices .....	102
Annex E (informative) Surges created by transfer switches.....	106

# IEEE Guide for the Application of Surge-Protective Devices for Use on the Load Side of Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits

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## 1. Overview

### 1.1 Scope

This guide covers the application of surge-protective devices (SPDs) for installation on the load side of the service equipment for 50 Hz or 60 Hz, ac power circuits rated 1000 V rms or less.

### 1.2 Purpose

The purpose of this guide is to provide users, specifiers, installers and manufacturers with guidance on the use, selection, application and installation of SPDs for installation on the load side of the service equipment for 50 Hz or 60 Hz, ac power circuits rated 1000 V rms or less.