Update on the Grounding Section

"Guide for the Application of Surge Protective Devices for Low Voltage AC Power Circuits"

C62.72 draft 10/08/13

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Presentation Topics

- SPDC WG 3.6.6 continuing work on C62.72
- Major updates in draft C62.72 – 10/08/13
- Problems(?) with grounding in C62.72-2007
- Grounding update to draft C62.72 – 10/08/13

SPDC WG 3.6.6 continuing work on C62.72

- Definitive upgrade work began in 2009
- Several Task Forces on important issues
- Cmte vote in 2013 to submit ballot version
- Ballot particulars recently finalized 03/2014
- Chair Ron Hotchkiss set to announce ballot
- Ballot Cmte selected

Major updates in draft C62.72 – 10/08/13 (With on-screen view of C62.72 draft)

- Change in Title, Abstract
- Specific work areas focused on by the working group
  - 28 citations listed
- Extensive revisions to Definitions, acronyms and abbreviations

Major updates in draft C62.72 – 10/08/13

- 5.3 Internally generated (switching) surges
  - 5.3.1 Normal operations
  - 5.3.2 Abnormal operations
- 7.6 Risk assessments
- 9.4 Available short-circuit current and SPD short circuit current rating

Major updates in draft C62.72 – 10/08/13

- 11 Grounding (earthing) and Bonding
  - 11.1 SPD grounding lead and related considerations
  - 11.2 Common bonding network
  - 11.3 Grounding
  - 11.4 Ground (earth) potential rise (GPR/EPR)

Major updates in draft C62.72 – 10/08/13

12.1 SPD faulted protection mode (N-G) relationship to load return current (neutral current) flowing on unintentional grounding/bonding paths

Major updates in draft C62.72 – 10/08/13

- 13.1.1 Surge tests
- 13.2 SPD surge current and nominal discharge current ratings
- 13.3 SPD maximum continuous operating voltage (MCOV)
- 13.4 SPD response time
- 13.5 Joule (energy) ratings
- 13.6 Rated load current

Major updates in draft C62.72 – 10/08/13

- 13.7 Fault current interruption capability
  - 13.7.1 Short-circuit current rating
  - 13.7.2 Load-side short-circuit capability
- 13.8 Temperature range
  - 13.8.1 Maximum operating temperature withstand
  - 13.8.2 Storage temperature
- 13.9 Load-side surge withstand
- 13.10 Voltage regulation (voltage drop) of an SPD
- 13.11 SPD power system configuration

Major updates in draft C62.72 – 10/08/13

- 13.12 SPD types
- 13.13 SPD enclosure rating
- 13.14 SPD status indicators
- 13.15 SPD disconnectors
- 13.16 SPD certification and safety considerations
- 13.17 SPD modes of operation
- 14.2 Temporary overvoltages (TOVs)

Major updates in draft C62.72 – 10/08/13

- 16 SPD coordination considerations
  - 16.1 Surge waveform and duration
    - 16.1.2 Combination wave surges
  - 16.2 SPD conductor (lead) length
  - 16.3 Distance between SPDs, types, location categories and IEC test classes
    - 16.3.1 Distance between SPDs
    - 16.3.2 SPD type terminology and location categories
    - 16.3.3 IEC Class I, II, and III test terminology
    - 16.3.4 Terminology and coordination

Major updates in draft C62.72 – 10/08/13

- 16 SPD coordination considerations
  - 16.4 Distance between the origin of a surge and the end-use equipment
  - 16.5 Surge-protective devices coordination
  - 16.6 Surge current capacity and nominal discharge current ratings of the SPDs
  - 16.7 Aging of SPDs
  - 16.10 SPDs integral to electrical distribution and end-use equipment

Major updates in draft C62.72 – 10/08/13

- 16 SPD coordination considerations
  - 16.11 Coordination of the SPD's SCCR
  - 16.12 SPDs used in a lightning protection system (LPS)
  - 16.13 Installation in hazardous locations
  - 16.15 SPD coordination and documentation
- Annex E – Surges Created by Transfer Switches

Problems(?) with grounding in C62.72-2007

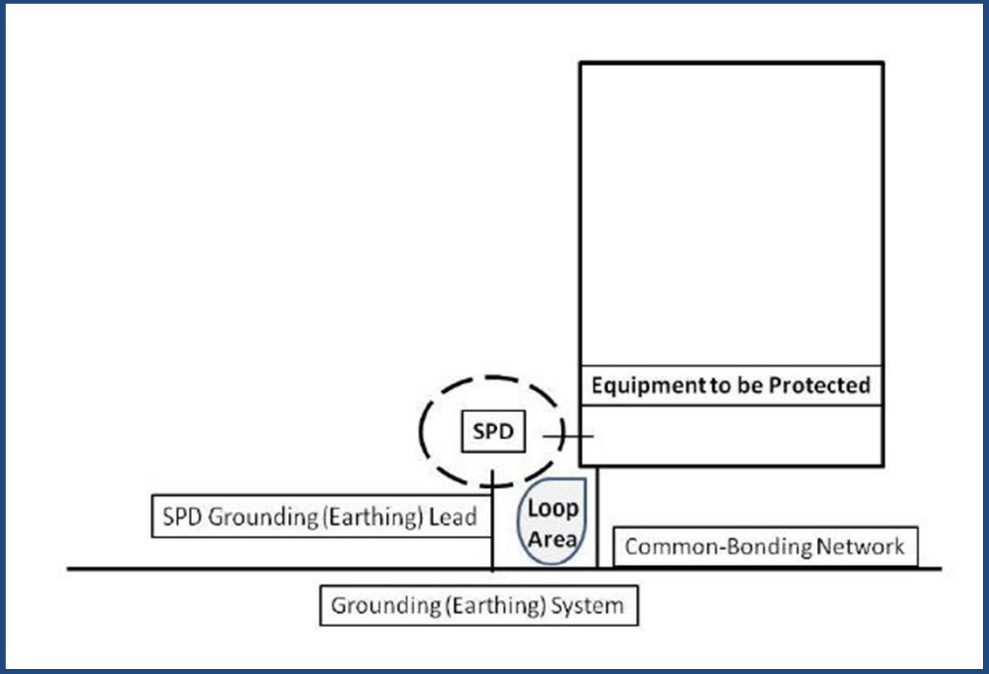
- Emphasized minimizing the earth impedance to optimize the lightning protection (LPS) performance of any installed SPDs
  - First "30 meters" impact lightning transient
- No mention of SPD wiring geometry relative to the formed loop area of the grounding lead and the equipment to be protected
- Overemphasis on N-G function of the SPD
- No coverage of SPD N-G "short" fault mode

Grounding update to draft C62.72 – 10/08/13

- The dispersion of the surge currents from the SPD grounding lead/terminal to earth is outside the scope of this standard
- The SPD grounding lead should be as short as practical and installed in a straight and direct manner as feasible.
  - Partial self-inductance of this lead will be the dominant impedance factor for the lead during a surge current event such as lightning

Grounding update to draft C62.72 – 10/08/13

- **Conceptual drawing of SPD installation geometry with a minimized loop area**

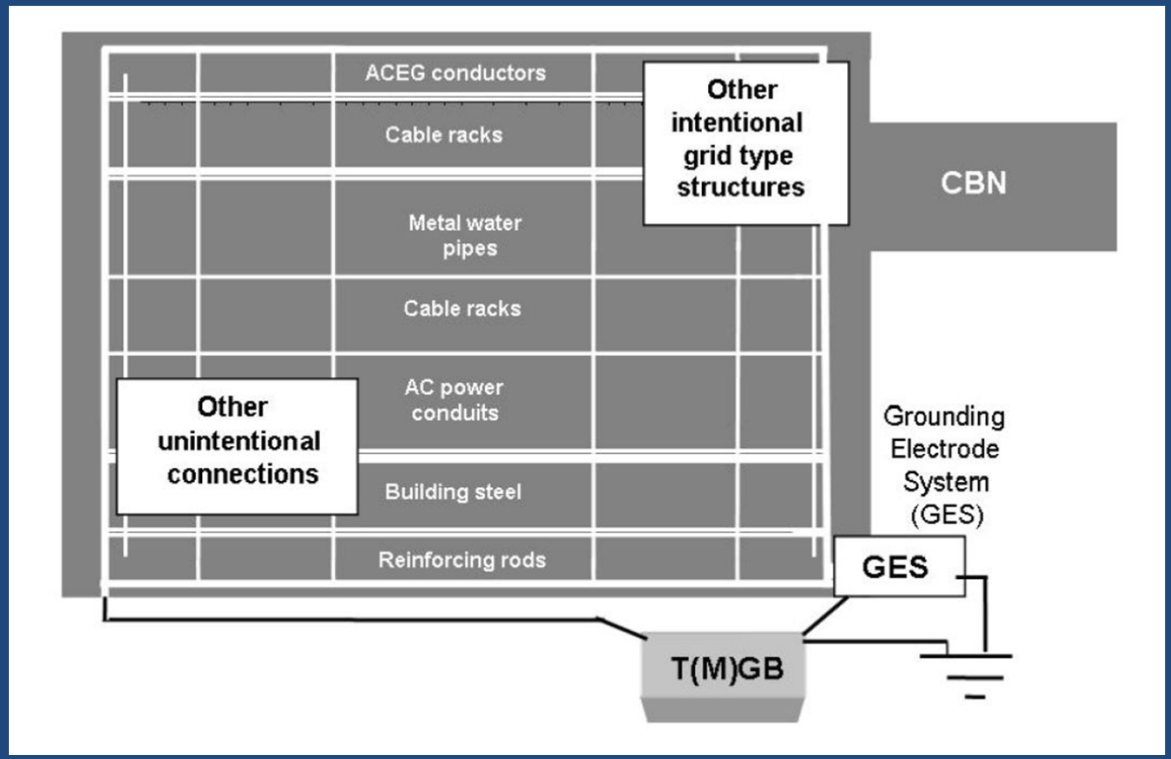


Grounding update to draft C62.72 – 10/08/13

- Other related SPD wiring considerations include
  - locating the SPD where interconnecting lead lengths are as short as feasible (to reduce lead partial self-inductance)
  - protected and unprotected leads are routed and dressed separately (to avoid cross coupling of transient energy)
  - leads enclosed in non-metallic bodies are twisted together (to reduce inductive coupling)

Grounding update to draft C62.72 – 10/08/13

- **Description of common bonding network**



Grounding update to draft C62.72 – 10/08/13

- **Grounding**
  - **Relative to the installation of SPDs, the condition of the grounding system for the common-bonding network should be inspected to ensure compliance to applicable electrical codes and lightning protection system requirements.**
  - **Attempts to reduce the net impedance value of the connection of the common-bonding network to the grounding system are unnecessary. Such a reduction does not improve the protective performance of the SPDs inside the facility.**

Grounding update to draft C62.72 – 10/08/13

- **Grounding**
  - **Therefore, more important than the absolute value of the grounding resistance or impedance is to ensure that all the equipment in the facility is referenced to the common-bonding network.**
  - **At a minimum, local/regional areas within the network raise/lower to the same relative potential during an impinging surge current event independent of the grounding system.**

Grounding update to draft C62.72 – 10/08/13

- **GPR (EPR)**
  - **The SPD can experience an injection of current from a local GPR which is not developed by that SPD. In effect, the SPD then injects current backwards (backfiring) from grounding into the input/output wiring of the SPD.**

Grounding update to draft C62.72 – 10/08/13

- GPR (EPR)
  - This difference in voltage, applied across the equipment (ports) or across a communication link between two pieces of equipment, can result in permanent damage as well as upset.
  - Equalizing these voltages can be achieved by proper routing of the input/output wiring through a single device, termed a Multiservice (Multiport) SPD (ports include ac power, coaxial, twisted pair, etc.).

Grounding update to draft C62.72 – 10/08/13

- 12.1 SPD faulted protection mode (N-G) relationship to load return current (neutral current) flowing on unintentional grounding/bonding paths)
  - Recognizes there can be N-G current due to a faulted SPD in “shorted” N-G mode
    - Not considered a safety hazard
      - EPRI tests confirmed

Grounding update to draft C62.72 – 10/08/13

- SPD equipped with an added N-G suppression mode installed at a main entrance panel or panel fed from a transformer is unnecessary
  - In countries where N-G bonds at building entrances are not required or are prohibited, the N-G suppression mode may be required at building entrances.

Grounding update to draft C62.72 – 10/08/13

Questions??